Smithsonian

LY 1998

Pierre Bonnard

[PAGE 32]

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COMPAQ

SMITHSONIAN

features

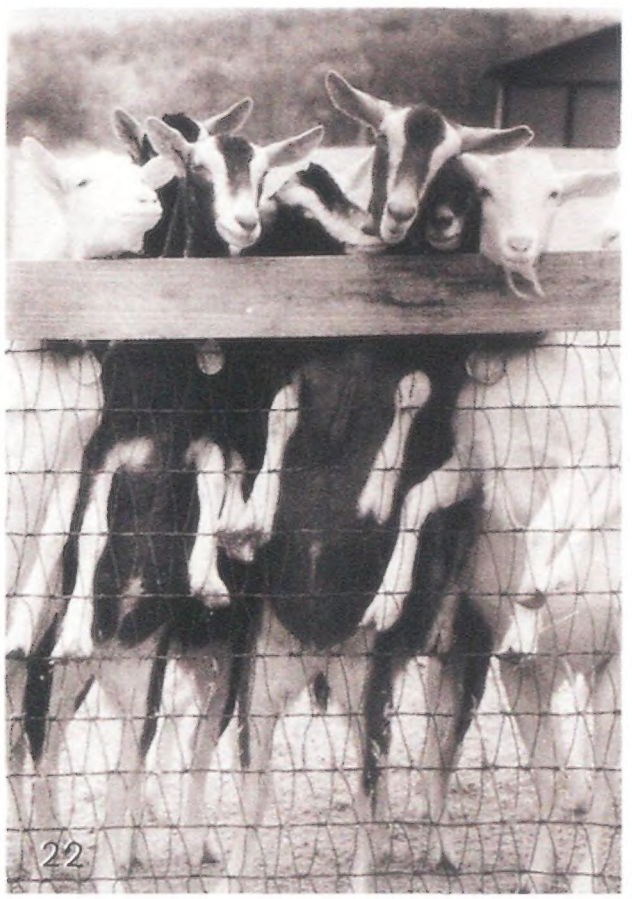
JULY 1998 ♖ VOLUME 29, NUMBER 4

22 New Breeds Down on the Pharm
Genetically altered cows, pigs and goats may soon produce drugs to treat a host of afflictions, from hemophilia to stroke
BY ALBERT ROSENFELD ♖ PHOTOGRAPHS BY THEO WESTENBERGER

32 Pierre Bonnard
So pleasing were his paintings that only after his death did critics grasp the daring experiments taking place on the canvas
BY STANLEY MEISLER

44 The Man Who Dreamed Up Madeline
Like the plucky character he created, Ludwig Bemelmans had an amazing way of getting into, and out of, one jam after another
BY ROBERT WERNICK

54 In Vermont, a Valiant Stand for Freedom
In conditions "worse than Valley Forge," the weary defenders of Mount Independence fought to buy time against the British
BY RICHARD WOLKOMIR ♖ ILLUSTRATIONS BY GREG HARLIN



66 Dance With the Devilfish
Watching manta rays "fly" up to them in the water, divers learn there's nothing demonic about these graceful creatures
PHOTOGRAPHS BY JEFFREY L. ROTMAN

72 Little Engines That Still Can!
Hauling lightbulbs to lumber, railroad entrepreneurs young and old are putting the nation's short lines back on track
BY KEVIN KRAJICK ♖ PHOTOGRAPHS BY CAMERON DAVIDSON

82 X Rays Expose a Violent Sky
A new X-ray telescope will give astronomers a better look at quasars, erupting stars and other galactic hot spots
BY MARCIA BARTUSIAK

90 Tangier
Pirates, pashas and lions—literary and real—fueled America's historic fascination with Morocco's city of intrigue and delight
BY JONATHAN BRODER

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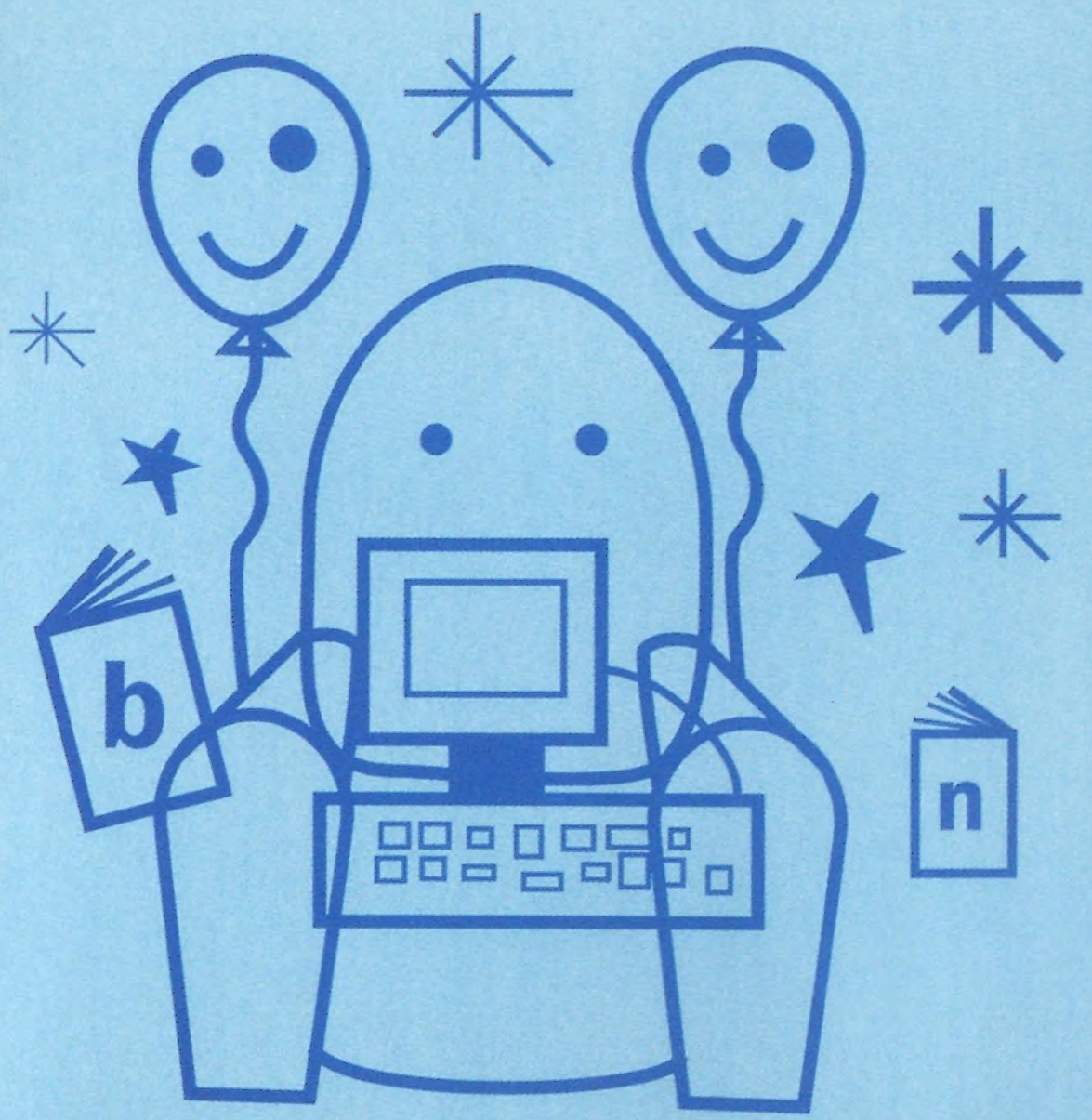

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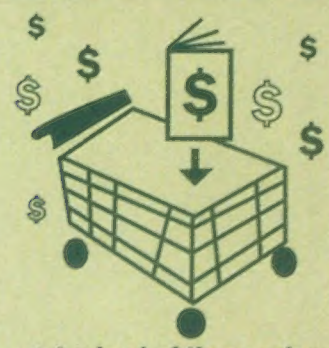

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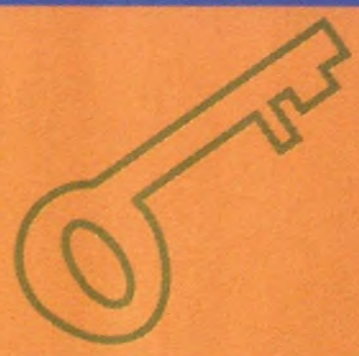

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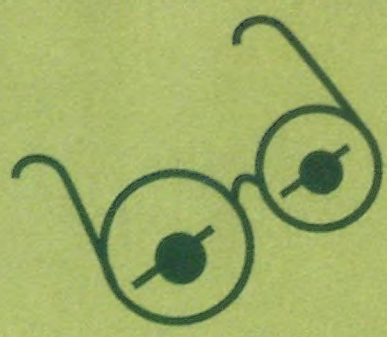

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departments

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COVER

Cover A flowering tree that was visible from his bedroom window was the subject of Pierre Bonnard's last work, *Almond Tree in Blossom* (1947), painted the year he died. Devoted to his art until the end, the frail painter had his nephew change the patch of grass in the bottom left-hand corner from green to gold because he decided the color wasn't right.
MUSÉE NATIONAL D'ART MODERNE, CENTRE GEORGES POMPIDOU

12 Letters to the Editor

101 Additional Sources

102 Smithsonian Study Tours

8 Smithsonian Perspectives
Long May It Wave
BY SECRETARY I. MICHAEL HEYMAN

14 The Object at Hand
A Metal Far From Base
BY JAN ADKINS

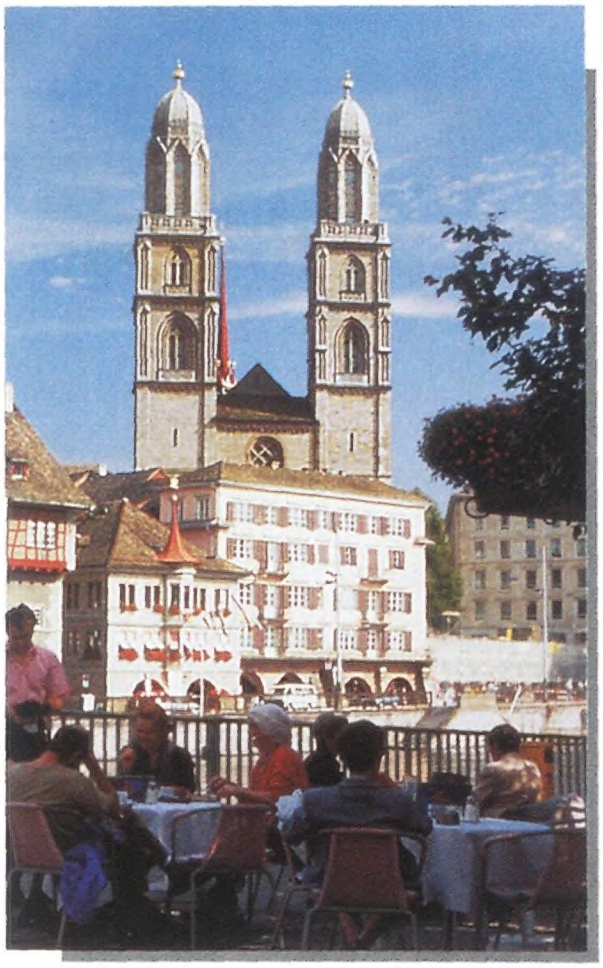
18 Smithsonian Highlights
Waiting, Waiting . . . CLICK
Highlights Calendar starts on page 20

104 The Last Page
Memory Blank
BY CYNTHIA CAVNAR

18

104

[A page out of a grand vacation memoir.]



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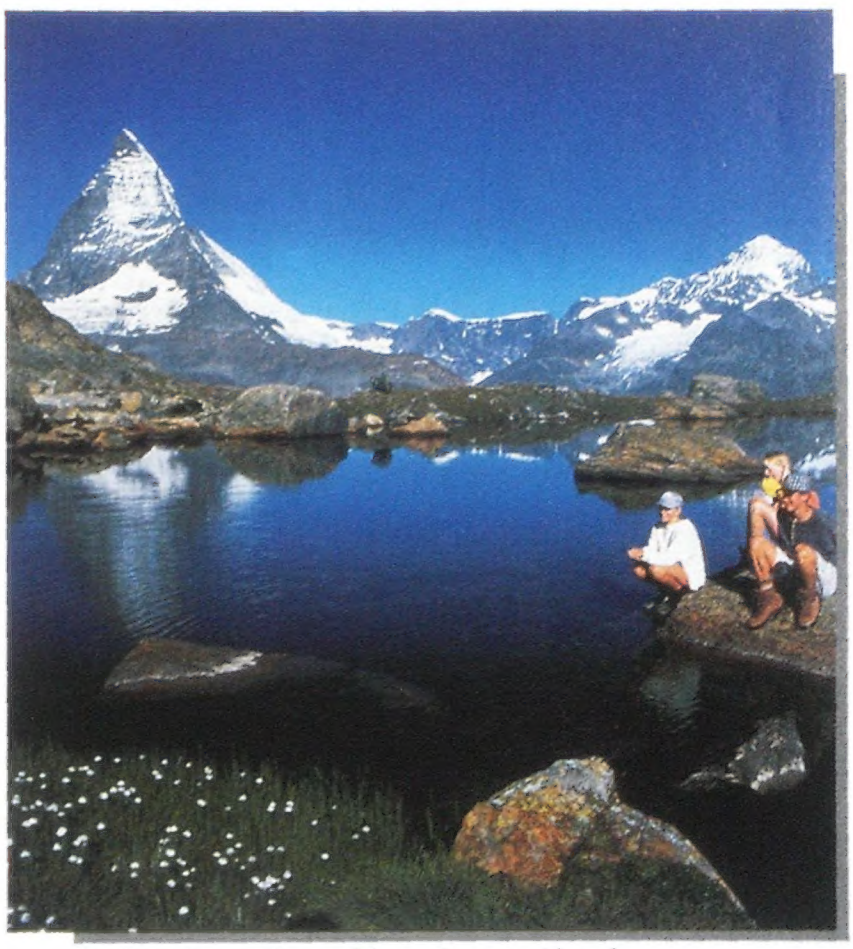

The Matterhorn, right out of the movies except it's real.

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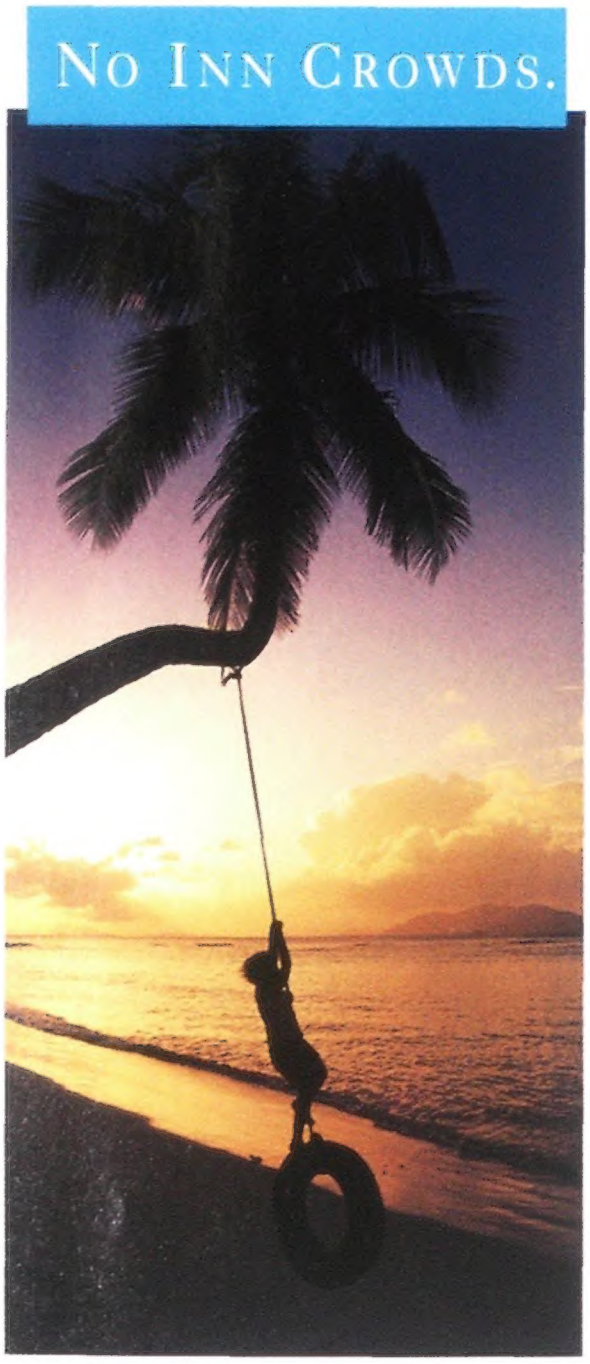

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SMITHSONIAN

PERSPECTIVES

Long May It Wave

THE SMITHSONIAN EMBARKS ON AN AMBITIOUS PROJECT TO PRESERVE THE STAR-SPANGLED BANNER

THE POWER OF OBJECTS IS A LESSON I HAVE LEARNED well since coming to the Smithsonian in September 1994. It was brought home to me again recently when an unsolicited letter came to my attention. The letter was written by a 10-year-old after her music teacher told the class that the Star-Spangled Banner at the National Museum of American History was in danger of deteriorating. The letter reads as follows: "To: Whoever this concerns, I think you should try to stop the American flag from fading. The flag is very special to me and it's been in America for so long I don't want it to fade. Please try to save it for me and for America."

It is a great satisfaction for me to be able to report to that little girl and to all of you that we have recently embarked on one of the most ambitious conservation projects in our history. The subject is the flag that flew over Fort McHenry in 1814 when Baltimore was under attack by the British. On September 13, Francis Scott Key, a prominent lawyer from Washington, D.C., was on a flag-of-truce ship during a brutal bombardment that lasted through the night. Extremely anxious for our fledgling nation, he feared the worst until, "by the dawn's early light," he saw that "our flag was still there." Overcome with emotion, he took a letter from his pocket and composed some verses that were later published and set to the music of a familiar English melody. In 1931, "The Star-Spangled Banner" officially became the national anthem.

The flag, which was made by Mary Pickersgill of Baltimore and her 13-year-old daughter, Caroline, was donated to the Smithsonian in 1912 by the grandson of the commander of Fort McHenry. The donor stipulated that it never be removed from the Institution, so that anyone visiting the Smithsonian would be able to see it.

Since acquiring the flag, which is made of wool bunting with cotton stars, the Institution has endeavored to preserve it properly, using state-of-the-art conservation and exhibition techniques. For many years it was displayed in a case in the Arts and Industries Building before its move to American History in 1963. The flag was last cleaned in 1982, and a flexible screen was installed to protect it from light and dust. Twelve years later, the cables holding the screen failed, prompting us in 1996 to convene a world-class team of experts who could advise us on the safest and most advanced methods for ensuring the flag's stability.

Early on in our deliberations we determined that the flag should continue to be on view throughout the conservation process (which may take three years) so that the public could observe and learn from it. In the fall, we will construct a laboratory in the museum with large glass windows and an exhibition describing the flag's history and the process of conserving it. Substantial educational outreach is planned as well, including video documentaries and curriculum kits that will be distributed to schools.

The challenges of moving the flag are daunting due to its age (185 years), fragility and size (it weighs about 150 pounds and measures 30 feet by 34 feet). To minimize stress and risks, it will be lowered this fall by attaching cables to the top and wheels to the bottom of its present aluminum frame. After the flag is laid horizontally in its frame, conservators will work in prone positions on a movable bridge assembled above it.

The conservation of the Star-Spangled Banner has been designated by the White House as a key element of Save America's Treasures: The Millennium Program. Fortunately for the American people, the Pew Charitable Trusts has stepped forward with $5 million for the project, with the expectation that the gift will be matched with federal funds.

Our need for funds, however, doesn't end with the flag. When it is reinstalled at American History, it will be the visual centerpiece of a significantly refurbished museum that will include more clearly defined spaces, a new visitors' center, new exhibits on American life and electronic access to objects behind the scenes.

It is this vision that we hope will engage corporations, foundations and American citizens of all ages, who will see themselves and their diverse identities reflected, explained and celebrated. We want to preserve the flag that uniquely symbolizes our unity, but also the millions of objects in our care that constitute precious reminders of our rich and complex heritage. And to do that, we will need your understanding and support in the months and years ahead.

I. MICHAEL HEYMAN, SECRETARY

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Thinking.

THE HORSE WHISPERER

THANK YOU FOR THE GREAT PIECE on Buck Brannaman by Paul Trachtman, in the May issue, and for the photographs by Ted Wood. I was at the same famous Ray Hunt clinic in Bozeman, Montana, where the light went on for Buck, and like him, I'm not sure what the term "horse whisperer" means. I do know that I communicate with my horses a whole lot better now than before that significant day at Ray Hunt's clinic. I go to at least one Brannaman clinic a year just to refresh my mind.

Life around my horses is now safer and less stressful because I've learned to watch them and to give them credit for having minds and emotions. I'm too small to muscle out a 1,000-plus-pound animal.

Carol Van Delinder
Belgrade, Montana

AS A SEVENTH-GENERATION HORSE person, I have been both interested and amused by the current fascination with "horse whisperers." Much of it seems to stem from the public's perception of horse breaking as being an old-time cowboy on a wildly bucking bronc. Those of us horse trainers who aren't cowboys, and never have been, are inheritors of a wholly different tradition of handling horses that stretches back all the way to Xenophon's fourth-century B.C. essays on horsemanship. For us, carefully and slowly nurturing a young horse from birth through the advanced stages of training is the way it has always been done.

I'm glad to see the popularity of the "horse whisperers" as clinicians and subjects of books and articles because it means more horses are going to enjoy this kind of relationship with their humans.

Barbara S. Holstein
Belmont, Ohio

LIKE DOGS, HORSES ARE A HIGHLY social species. The trick for humans is to communicate well enough to become the social leader. I once had a horse that I could not control, so my wife and I traded. At her hands, the horse became a wonderfully responsive creature. She told me, "You don't tell this horse what to do; you come to an agreement."

The conflict style is very much a male thing. I have seen trainers who appeared to aggravate their horses deliberately so that they could show off their horsemanship by handling the irritated beasts. This is another situation where wise men should emulate women.

Quentin Llop, DVM
Caledonia, New York

A PRE-CIVIL WAR HORSE TRAINER IN Ohio, named John S. Rarey (1827-65), appears to have used a technique similar to Buck Brannaman's and with equal success. Rarey's career started in Groveport, where people came from miles around to watch the gentle boy tame horses. In his 20s, he wrote a book about his methods. His reputation took him to Canada and on to London, where he gave exhibitions. At a command performance before Queen Victoria, he soothed Prince Albert's wildest colt in less than 20 minutes. He became the subject of sonnets, and the "Rarey Waltz" was composed in his honor.

At a large January 1858 exhibition, Rarey worked with a horse owned by Lord Dorchester named Cruiser, which was allegedly well bred but mad. Cruiser wore an eight-pound iron muzzle, and several men had to hold him. Rarey, of course, tamed him with kindness and took off the muzzle. The two toured the world and were feted by royalty.

Rarey returned to Groveport and built a mansion, where he died at 38. Cruiser lived nine more years but became vicious once again. Groveport High School was built on the site of Rarey's mansion, and its teams are called the Cruisers.

Herb Hildebrand
Kettering, Ohio

THE OBJECT AT HAND

AGAINST MY MOTHER'S BETTER JUDGment, she let my father name me after Barney Oldfield, whose Winton Bullet No. 2 was your object at hand. When I first met my namesake at the Nebraska State Fair, the "daredevil of the earth" was racing against his aviation counterpart, Lincoln Beachey. Barney won. Afterward, he lifted me up into the seat of his car and gestured with his well-chewed cigar, declaring: "Son, all your life people are gonna ask you if you're a relative of mine. You tell 'em you're my cousin. There ain't very damned many Oldfields, so that's gotta be true." He was superhuman; anything he said could have been law.

Two decades later we met again, and we kept in touch. When World War II came along, I volunteered for parachute school, and a story came out of Fort Benning that said, "Either the nerve or the insanity in the Oldfield family is intact, as a Capt. Barney Oldfield has just become a paratrooper!" Barney immediately wrote that he knew I would "hold up the name and nerve of the Oldfield clan," but to remember his old saying that "there's a difference between having nerve and being a damned fool. I have always contended that anyone without fear is somewhat devoid of intellect—of course, anyone with too much fear in his system will make him over-cautious." His counsel was mighty comforting the day before my first qualifying jump.

After the war, I helped him work his tales into several 750-word sports columns with "By Barney Oldfield" at the top. He attached a memo to each, stating that it was a "rare literary document," as he was, he claimed, the only person who had the same name as his ghostwriter.

Col. Barney Oldfield
Beverly Hills, California

JOSHUA SLOCUM

IN YOUR ARTICLE ABOUT JOSHUA Slocum you noted that Tierra del Fuego (Land of Fire) was named for the signal fires that bands of savages lit along the shore. The fires, however, were not signals.

Ferdinand Magellan gave the archipelago its name after observing itinerant family groups of Indians, wearing little or no clothing, transporting the fires from beach to beach in carved-out tree canoes.

Daniel Escarra
Coral Gables, Florida

Joshua Slocum's book *Sailing Alone Around the World* and other sources described them as signal fires, but recent scholarship indicates that their primary functions were for providing warmth and for cooking. Ed.

LAST PAGE

TO PROTECT HIS GARDEN FROM WILDLIFE, Gerald Dumas needs a good dog. We grow produce for a local farmers' market, and our county, which abuts a national forest, is a haven for all kinds of mammalian herbivores. Our 12-pound Norfolk terrier, Ace, is an integral part of our pest-control system. She has been trained to stay out of the raised beds, and she patrols the perimeter and aisles, leaving her canine scent behind and chasing any intruders she finds.

We hypothesize that deer, rabbits and groundhogs can't tell the smell of a 12-pound dog from a 112-pound pooch. At any rate, we rarely have predation problems, and our garden isn't fenced.

Hazel E. Keeler
and Michael E. Kurtz
Newport, Virginia

WRITE TO SMITHSONIAN

Send letters for consideration in this column to SMITHSONIAN Letters Editor, P.O. Box 44400, Washington, DC 20026-4400, or to LettersEd@simag.si.edu. Letters may be edited for clarity and length. Send all other queries and comments to SMITHSONIAN, 900 Jefferson Drive, MRC 406, Washington, DC 20560, or see www.smithsonianmag.si.edu.

A Metal Far From Base

A TINY FLAKE STARTED THE RUSH TO CALIFORNIA, BUT WHERE GOLD IS CONCERNED, THAT ISN'T THE HALF OF IT

BY JAN ADKINS

IT IS A TINY THING, A FLAKE OF BRIGHT METAL about the size of a contact lens. A card from the National Museum of American History lists its weight at just .0855 grams.

"San Francisco, 1848," the card reads. "This paper contains the first piece of gold ever discovered in the northern part of Upper California." Looking at it any American feels a surge of recognition: "Dwelt a miner, forty-niner, and his daughter, Clementine." This is the little glint of real gold, what the boys called "color," that James Marshall noticed in the tailrace at John Sutter's mill on the American River. We all know the story, or think we do. San Francisco, recently transformed from the village of Yerba Buena, with a population of about 800, quickly became a sprawling corrupt city. Its huge harbor was choked with hundreds of rotting ships that couldn't sail home because their crews had fled to the goldfields.

Even so, the rush was slower to start than is usually thought. James Marshall actually found the gold, a tiny nugget that he beat flat to test its malleability, on January 24, 1848. The find was not reported in the *California Star*, San Francisco's hand-cranked newspaper, until the first of April; even then there was no great stir. It wasn't until the 12th of May, after trader Sam Brannan waved a bottle of gold dust at a crowd, shouting "Gold! Gold! Gold! from the American River!" that the first rush began.

The military governor of the California Territory, Richard Mason, accompanied by his aide, a young lieutenant with a bright future named William T. Sherman, visited the goldfields on a fact-finding mission for a skeptical government in Washington. Sure enough, their report said, people were finding gold. In December 1848, in his State of the Union Message, President Polk acknowledged the gold strikes of California. By the end of the following year, 80,000 souls were already on their way west—about 42,000 overland and 38,000 by way of Panama or Cape Horn.

Gold was then valued at $18.80 an ounce; today an ounce sells for about $300. So the little flake at American History might now bring less than a dollar on the open market. Monetarily, it's hardly worth keeping, except as a historic collector's item worth thousands of dollars. Whatever its price, gold is an extraordinary metal, not only arbitrarily precious but possessed of fascinating properties in itself. The remarkable quality of gold is that it combines only with mercury, cyanide and aqua regia (a nasty mixture of nitric and hydrochloric acids). Tumbled and ground in the blender of the geologic past, it is still largely found in veins of pure metal. Unlike most metals, it also resists oxidation. Wherever gold lies buried, it keeps its sunlike glow forever.

This fragment, glimpsed by James Marshall in a tailrace on the American River in 1848, led to a lot more than the gold rush.

It is also highly conductive electrically—your calculator and the computer I'm writing on have gold contact points—and is so malleable that it can be beaten out into leaf of unbelievable thinness, a few molecules deep. Yet even this whisper of material retains an extraordinary reflectivity and opacity, which is why gold is used in foil to protect satellites from sun damage and is laminated into sun shields in fliers' helmets.

The miners who worked on the American River in 1849 were following a trail of gold dust and nuggets washed downstream from large veins of pure gold in the Sierra Nevada. The malleability of gold allowed tumbling flakes

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to impact-weld themselves into larger and larger nuggets, and its shine made it easier to find.

In the first years they worked the streams swirling gold-laden silt in wide, shallow pans until only the heavier particles remained in the bottom. They also built rocker boxes and flumes with baffles in which the gold collected. Some miners even collected small flakes by anchoring a fresh sheepskin in the water; gold stuck to the lanolin, while finer silt was dissolved away.

History and romance have both softened the breathtaking hardships of the gold camps. Violence and despair were the depressing bottom line for most miners. Only a few got rich and many were ruined; this was probably one of the reasons miners often looked and acted a bit like madmen. What is usually ascribed to gold fever or rotgut whiskey or bad women was more likely due to poisoning by mercury, a much less benign metal than gold. One of the odd historical coincidences about the gold rush is that it was preceded a few years earlier by a less ballyhooed mercury rush. Mercury deposits were found in Northern California in a region quickly named Almaden, after the site of Spanish mercury mines that had supplied Europe with quicksilver since Roman times (the name has since been transferred to the California wine valleys nearby). Though we now know that mercury fumes aggressively attack the brain, beginning in the 1850s mercury was often used to consolidate and isolate gold. When mixed with gold-bearing dust, and heated, the mercury burned away, leaving melted clusters of gold. Miners often burned the mix in their cabins, breathing in toxic fumes.

Gold is an element distributed pretty much everywhere on the globe. The first serious American gold rush occurred in Georgia in 1829. There are gold rushes going on right now in Indonesia, Guyana and Brazil. One of the most impressive nuggets of gold—a lump bigger than a sweet potato—in the Janet Annenberg Hooker Hall of Geology, Gems and Minerals, in the National Museum of Natural History, was found in the very productive Whitehall Mine, owned by the United States Mint, only eight miles up the Potomac from the Natural History building and the Mall. Hikers can still pan gold out of the muddy Potomac River.

Though hardly anybody got rich from gold, legions profited from real estate and business—the business of supplying hordes of miners. One celebrated example is the merchant who, seeing how fast miners' pants wore out, began making them out of tough tent canvas, eventually securing them at key points with copper rivets. He was Levi Strauss, the inventor of Levi's.

But John Sutter, the man who might have profited most, the man on whose land gold was found, became a classic victim of the rush. A German immigrant, kindly, enterprising, and surely one of the most unlucky businessmen in history, Sutter was constantly starting new commercial schemes with folks like Marshall. Characteristically, Sutter commissioned him to build a sawmill too far up the American River to be practical. Sutter owned thousands of acres of California land. Miners simply swarmed over it, then filed claims on it. The law-abiding Sutter sought recourse in law (in a lawless territory) and the United States Land Commission. Fond hope. He lost everything. "What a great misfortune was this sudden gold discovery for me!" he wrote. "Instead of being rich, I am ruined, and the cause of it is the long delay of the United States Land Commission of the United States Courts, through the great influence of the squatter lawyers. . . ."

All because of a tiny flake barely big enough to put on display, the minuscule seed of dramatic change.

In 1849, a miner sluices dirt down to a baffle that separates out the heavier gold.

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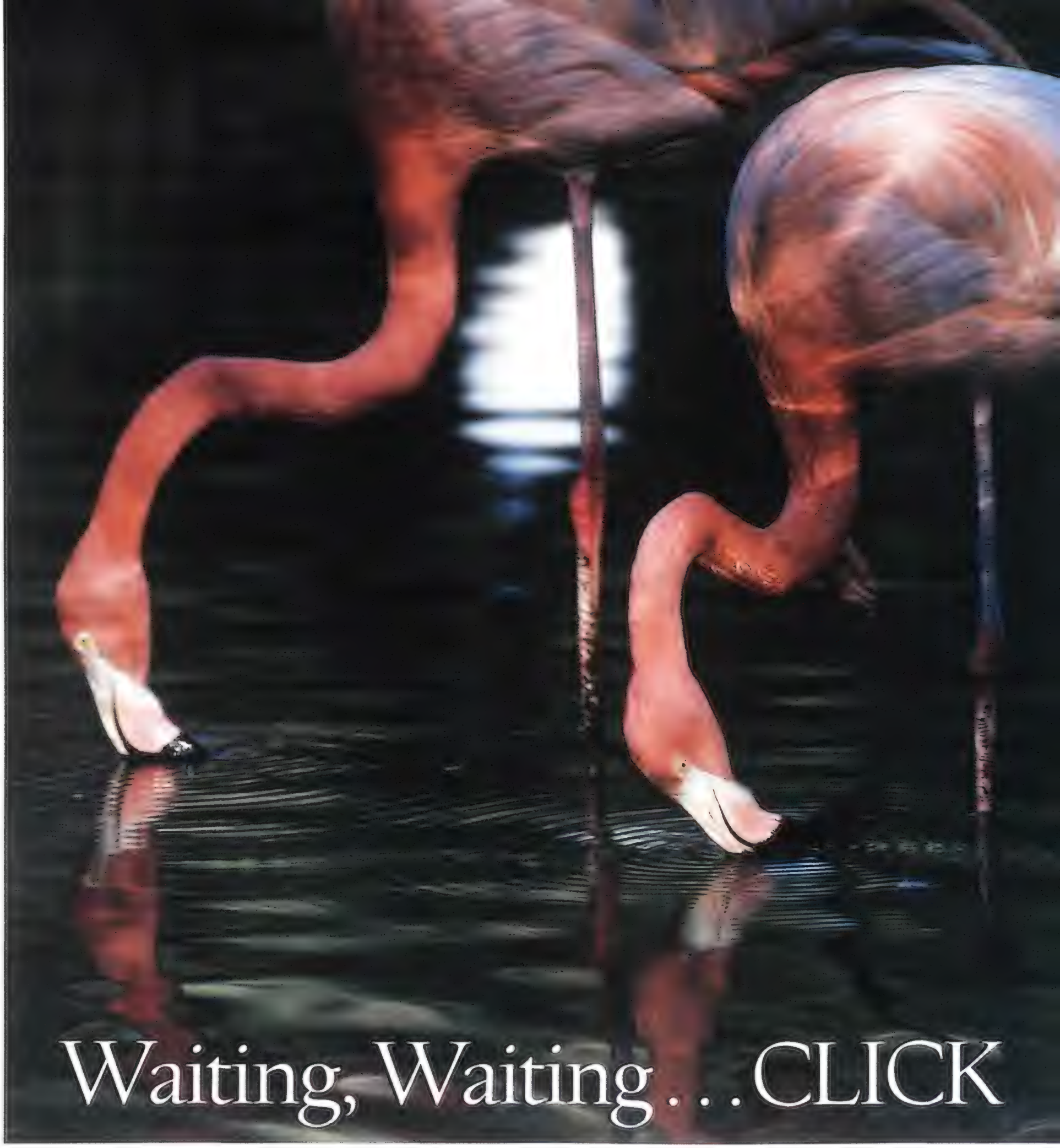

Waiting, Waiting . . . CLICK

"DEEP FOCUS IS WHAT YOU NEED. I CROUCHED in the bushes until my knees ached, hoping for this picture to compose itself," says photographer Chip Clark. "Flamingos feed by dipping their bills into the water and straining out crustaceans and other stuff they love to eat." All those shrimp are why their feathers are pink. The rapid pumping motion of their bills caused the close ripples. Equipment matters, of course. "For this shot, I used a 500-millimeter fluorite lens—a legendary lens, very sharp, superb optics. But it costs $6,000. These birds were wonderfully serene—going about daily life as they have for millennia." An exhibition of Clark's images will be on view at the National Museum of Natural History through September 7. You can also see his work at www.smithsonianmag.si.edu (click on Image Gallery). —*Bruce Hathaway*

SMITHSONIAN HIGHLIGHTS

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HIGHLIGHTS

Art Night on the Mall

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Exhibitions, Events

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Learn what's new at the Smithsonian and other capital attractions; films, touch screens, maps and more. Opens at 9:00 A.M. daily.

NATIONAL POSTAL MUSEUM

Fifth Anniversary Birthday Celebration (July 30) All-day festivities, including appearances by Ben Franklin and Bugs Bunny.
Our Town: Mural Art of the New Deal (through September 8)
Artistic License: The Federal Duck Stamp Story Fifty new objects.
What's in the Mail for You! Innovative, hands-on exhibition about the direct mail industry.

INTERNATIONAL GALLERY, S. DILLON RIPLEY CENTER

The Jewels of Lalique (through August 16) Considered the greatest artist-jeweler since the Renaissance, René Lalique (1860-1945) used the full array of goldsmith's techniques to design the first "modern" jewelry. The show features more than 230 pieces.

COOPER-HEWITT, NATIONAL DESIGN MUSEUM
[NEW YORK CITY]

Fountains: Splash and Spectacle (through October 11) European and American fountains, from the Renaissance to the present.
Under the Sun: An Outdoor Exhibition of Light (through October 25) Sundials, solar collectors and more.

HEYE CENTER, NATIONAL MUSEUM OF THE AMERICAN INDIAN
[NEW YORK CITY]

Indian Humor (through August 2) Works in a variety of media.

NATIONAL MUSEUM OF AMERICAN ART

David Hockney's Grand Canyon (through September 7) Panoramic oil painting, 24 feet wide.
Posters American Style (through August 9) Poster graphics, circa 1895-1995.
Stuart Davis (through September 7) Fifty-six paintings by one of America's finest modernists.

NATIONAL PORTRAIT GALLERY

Faces of Time: 75 Years of Portraits for Time Magazine (through August 2) Cover portraits commissioned by *Time* magazine.
Celebrity Caricature in America (through August 23)

FREER GALLERY OF ART

Japanese Art in the Age of Koetsu (through February 5, 1999) Cultural renaissance in early 17th-century Kyoto.
Charles Lang Freer and Egypt Freer's collection of Egyptian artifacts.
Masterworks of Indian Painting II (through January 10, 1999) From the Mughal dynasty and the Rajput courts.

ARTHUR M. SACKLER GALLERY

Khmer Ceramics Rare glazed vessels from the 9th to the 14th century.
Ikat: Splendid Silks from Central Asia (through September 7)

NATIONAL MUSEUM OF AFRICAN ART

Olowe of Ise: A Yoruba Sculptor to Kings (through September 7)
The Ancient Nubian City of Kerma, 2500-1500 B.C. Ceramics, jewelry, more.
The Ancient West African City of Benin, A.D. 1300-1897 Various artworks.

HIRSHHORN MUSEUM & SCULPTURE GARDEN

Directions—Tony Oursler: Video Dolls with Tracy Leipold (July 2-September 7) Video-animated sculptures.
Triumph of the Spirit: Carlos Alfonzo, A Survey (1975-1991) (through September 13) Paintings, works on paper.
The Collection in Context: Henry Moore (through September 7) The sculptor's

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1937 work in cherry wood and string.

NATIONAL AIR AND SPACE MUSEUM

Business Wings (through May 31, 1999) The history of business aviation—from biplanes to "bizjets."

NATIONAL MUSEUM OF AMERICAN HISTORY

Between a Rock and a Hard Place: A History of American Sweatshops, 1820-Present (through October 30)
Information Age: People, Information and Technology

NATIONAL MUSEUM OF NATURAL HISTORY

Janet Annenberg Hooker Hall of Geology, Gems and Minerals Spectacular new permanent gallery showcases the National Gem Collection, a copper mine and much more.

Natural Selections: Museum Photography by Chip Clark (through September 7) Animals, plants, caves, jungles, myriad specimens, scientists, model makers and conservators have been among NMNH photographer Clark's subjects (in a quarter million shots!) over the past 25 years. On exhibit are 33 large-scale prints. See page 18.
In Search of Giant Squid The world's largest invertebrates.

NATIONAL ZOOLOGICAL PARK

The Birds of Paradise Lost The distinctive birdlife of the Hawaiian Islands.
Think Tank The biology and evolution of animal thinking with a focus on orangutans.

ARTS AND INDUSTRIES BUILDING

Speak to My Heart: African American Communities of Faith and Contemporary Society The role of the black church.

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New Breeds Down on

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PLAIN OLD BARNYARD ANIMALS—WITH GENES FROM OTHER SPECIES ADDED—ARE PRODUCING MEDICINES THAT KEEP PEOPLE ALIVE

BY ALBERT ROSENFELD

NO CREATURES LIKE THESE HAVE EVER existed on earth. Though not human, they turn out copious amounts of human hormones and enzymes. So far they live mostly in laboratories and protected pastures. They are composite creatures—chimeras. More precisely, they are animals whose genetic machinery has been engineered to churn out alien biochemicals. We call them "transgenic" because one or more of their genes have been brought across the gap between one species and another. Transgenic manipulation is old news for commercially valuable plants. But doing the same kinds of things in mammals is new—and it hits closer to home.

Why work this dark magic? The original purpose was to acquire basic knowledge about how genes function and what makes them malfunction. Implicit in the research, however, were medical and commercial objectives. Some of the altered animals produce relatively large quantities of heretofore rare hormones or antibodies. In other animals, specific genes have been inactivated so that the altered organisms mimic human diseases, making them models for research. If you want to study atherosclerosis, for example, you can add genes so that a mouse will simulate this condition.

Today, if you wanted to transplant a

PHOTOGRAPHS BY THEO WESTENBERGER

These holstein calves in Texas are the first transgenic cloned cattle. Their extra gene is just a marker to show that the process worked.

"We can translate the genetic code, write in it, and modify it as if we were rewriting sentences."

pig organ into a human, chances are high that it would be rejected. Soon, though, it may be possible to insert into the chosen strain of donor pigs one or more genes that will direct the manufacture of proteins to offset the rejection mechanism. You can also take a gene that produces a useful substance from any species that has it, even a bacterium, and insert it into a cow genome so that it is expressed only in the udder cells. (A genome is the set of instructions embedded in every cell's nucleus.) What then? Why, just milk the cow.

In a transgenic animal, one or more genes from another species have been inserted into its egg cells. (Or the animal's own genes have been altered.) The foreign genes are incorporated into the genome, where they will produce the same result as in their "home" organism; the genes are said to be "expressed." Because the new genes have been planted into the germ cells, the traits they carry are now passed on from generation to generation.

"It's not preposterous to predict," says Robert J. Wall, a biologist with the U.S. Department of Agriculture (USDA), "that a modest-size herd of 'pharm' animals could turn out the entire world's supply of a given drug." Wall works at the Agricultural Research Service facility in Beltsville, Maryland, where transgenic pigs and sheep are already pastured. Even as he speaks, he is getting ready to insert genes into a cow egg.

There are setbacks as well. This same day I have seen a sheep in which a gene to make human growth hormone has caused diabetes, and a pig in which the hormone has caused such grotesque overgrowth of its hind quarters that it can barely walk.

In making a transgenic animal, the target egg is usually prefertilized—though, strictly speaking, conception has not yet taken place. When sperm penetrates an egg, two pronuclei form, one containing the egg's own chromosomes, the other the chromosomes newly contributed by the sperm. The foreign genes will be inserted into one of those pronuclei. They then merge. What appears on the television monitor next to Wall's microscope, he explains, "is what I see in my eyepieces—a microdrop of culture media. The cluster in the center, taking up maybe 10 percent of the space, contains an even dozen eggs." He steadies an egg with a glass tube that's just slightly bigger than the egg—only millionths of an inch in diameter—and fire-polished so as not to cut into the egg's outer membrane.

The image grows as Wall maneuvers the eggs into strategic positions, zeroing in on one egg at a time. A syringe will shoot in a solution containing 200 copies of a hybrid mouse-cow gene. The necessary DNA coding sequences that determine when the gene will be turned on or off have all been taken from the mouse genome. The gene itself contains the code for producing an iron-binding bovine protein called lactoferrin; in collaboration with antibodies, it helps cows resist mastitis, a bacterial inflammation of the udder.

Lactoferrin fights the infection by disrupting the iron metabolism of the culprit bacteria. The trouble is that usually not enough of it is naturally present during lactation to do the job. If a significant number of the hybrid genes settle into the cow genome, however, they should shore up those defenses. These mouse controls are engineered to ignore the bovine signals that command the cow's own lactoferrin genes to turn off at critical times. So the mouse-run genes should keep those infection-fighting lactoferrin assembly lines working round the clock.

All these genetic tricks were learned first in mice, of course. Of the scores of geneticists who pioneered this frontier, no one has contributed more than embryologist Ralph L. Brinster of the University of Pennsylvania's School of Veterinary Medicine. His most celebrated—though not necessarily most important—experiment was a collaboration that used growth hormone to produce a transgenic "supermouse" that grew almost twice as big as any of its littermates. There is hardly any branch of transgenics in which Brinster's presence has not been felt. It was in fact Brinster, the mouse expert, who taught Bob Wall and his colleagues at the USDA how to transfer genes into cows, pigs and sheep as well.

"When people look back, 50 years from now," says Brinster, "our ability to modify life-forms will be seen as one of the most important developments in the 20th century. Up until this present era," he reflects, "we in the biological sciences were restricted to doing things like observing, describing, dissecting, measuring, weighing, and even manipulating in a gross sort of way. But what an enormous step we've now taken! Think of it—for the first time, we not only know there is a genetic code; we have deciphered it. We can translate it, read its messages, write in it, and modify it by employing its own language, as if we were rewriting sentences and paragraphs in an instruction manual. And now we can insert the appropriate 'words,' along with the messages that turn them on and off, into the genome of the fertilized egg. As the cells di-

Not transgenic themselves, these yearling goats in Massachusetts will be used to generate progeny that are. They, in turn, will produce pharmaceuticals.

vide, the new message we've written will automatically be part of the instruction manual in every cell."

Scientists have developed other ways to insert genes. Enlarging the pores at the cell's membrane, by electrical or chemical means, allows foreign genes to enter and find their way to the genome. Retroviruses, too, can carry the genes into the targeted cell. (In retroviruses, the genetic material is RNA rather than the usual DNA. Retroviruses carry enzymes that enable the RNA to copy itself into DNA molecules in a host cell so it will produce more retroviruses and become part of the genome. HIV is a retrovirus.) Ingenious techniques have been devised to guide genes not merely to just anywhere they happen to land in the cell's genome but to precisely defined sites.

One of the favorite uses of transgenics in mice, however, has been to seek out a healthy gene and inactivate it. This is done by adding foreign DNA that blocks the gene in question from doing what it normally does. Why would anyone want to do that? By knocking out the gene for a protein missing in the blood of hemophiliacs, for example, you produce a perfect mouse for studying hemophilia. And so it is for a host of diseases. The first few "knockout" mice for diseases such as cystic fibrosis and beta-thalassemia, a disorder of hemoglobin metabolism, were big news. Today there are knockout mice, sold by the thousands, for hundreds of diseases.

The most famous transgenic mouse (although not a knockout mouse) is probably still the "oncomouse" (*onco* for cancer, as in "oncologist"), produced in 1984. This mouse was highly susceptible to mammary cancer. It gained its celebrity, some would say notoriety, four years later when its Harvard producers were awarded a patent, which they licensed to DuPont.

Transgenics has led to a radical new way of looking at farm animals as well. They are now perceived by some as living pharmaceutical factories. If you can successfully implant the desired gene or genes with the appropriate regulatory DNA sequences, you can make the transgenic offspring of that animal produce whatever protein those genes code for, then harvest it by the udderful via old-fashioned, low-tech milking.

Business analysts once pooh-poohed the notion of transgenic pharmaceutical, or "pharming," companies becoming viable investments anytime soon. Indeed, a few companies, begun with high hopes, quickly foundered. But those with the resources to persist—and new companies now forming—are finally able to show results. The first transgenic cow entrepreneurs had an especially rough time of it. In one run of experiments in the Netherlands, a company now called Pharming Holding NV started with 2,000 eggs obtained from a slaughterhouse and fertilized with frozen bull semen. Out of this lot, they got 103 implantable embryos but only 21 pregnancies—and two transgenic cows.

Of their first batch, the only animal to acquire the intact gene turned out to be a male named Herman, obviously not a milk producer. Soon, however, entrepreneurs recognized that the most valuable transgenic animal is a "founder" male, able to sire a whole herd or flock of milk-producing females. Critics wanted to know how sure the scientists were that transgenes would not adversely affect the animals. Herman had by then sired a number of females who were already producing significant quantities of human lactoferrin in their milk. (Human lactoferrin is used to treat or prevent gastrointestinal infections in patients with impaired immunity.)

The Dutch government closely controlled all the research. An ethics committee was to determine if being transgenic harmed the animals in any way. The permit that allowed Herman's creation specified that after a cer-

All these sheep in Beltsville, Maryland, are transgenic except the one third from the right. They carry a gene that may block a common virus that depresses the immune system of sheep.

tain length of time, he and his offspring would be killed to prevent their mixing with nontransgenic animals. As a compromise, Herman was spared but castrated.

Once a transgenic animal exists, it can be reproduced in the usual way. There is another way as well to multiply such an animal: cloning. The company produced two cloned cows. A second ethics committee will have to see proof that the proteins produced by transgenic cows are effective before any more cows, transgenic or otherwise, can be cloned.

Pharming Holding NV's transgenic product plans include blood-clotting factors (fibrinogen and factor VIII) through its American subsidiary, Pharming Healthcare, Inc., which in turn is allied with the American Red Cross. The American Red Cross? The public knows ARC best as an agency that responds to disasters, but that's only half the organization. The other half is a biomedical services division whose specialty is blood products. "We are constantly concerned," says William Drohan, head of ARC's Plasma Derivatives Laboratory, "about the safety and purity of the proteins we make from six million units of donor blood. Whole blood is seldom transfused [SMITHSONIAN, March 1995]. What patients are more likely to get is plasma or platelets or red blood cells. Even so," he adds, "we can't offer a rock-solid guarantee of 100 percent safety or plentiful supplies at reasonable costs.

"Most people need very few transfusions in their lifetime, usually in connection with surgery. But hemophiliacs, for example, need naturally occurring enzymes called clotting factors that promote clotting of the blood. Factor VIII alone costs the average hemophiliac about $50,000 a year, and there's a residual worry about the risk of AIDS or hepatitis. Even so, it's always in short supply all over the world.

"Even scarcer than factor VIII or factor IX," says Drohan, "are some newly discovered blood proteins which may be medically valuable. Protein C is an example. It could be useful in a number of human ailments, even a lifesaver, at times, in heart attack or stroke. It's extraordinarily difficult to extract protein C from human blood. So where can we place our hopes for a safe, cheap and abundant supply? Would you believe . . . in the milk of transgenic pigs?"

Milking pigs is a relatively novel activity. About ten years ago, when Drohan was starting at ARC, a talented pharmaceutical engineer named William H. Velander had just moved to Virginia Tech in Blacksburg. When they met at a scientific conference, the two immediately recognized a deep mutual interest: trying to get transgenic animals to produce human proteins in their milk. The work started with mice, then moved on to pigs, Velander's chosen animal. Velander selected the pig for four reasons. A sow can produce a dozen or more viable offspring at a

time, while for other large domestic animals even twins or triplets are problematic. A sow's milk volume is reasonably high. The time to maturity—and therefore milk—is half that of a cow. And fourth, there's a long track record of safely using porcine products (insulin and factor VIII, for instance) in humans.

A bandage that can seal a wound in record time? "You can bet the Army is very interested."

The first transgenic pig, Genie, was born in 1990, but Virginia Tech scientists had to wait a year before they learned that Genie could produce large amounts of human protein C in her milk. Further refinements have considerably boosted that output. "Those transgenic pigs should provide us with a long-term reliable source of safe and low-priced anticlotting and clotting factors," says Velander. Drohan agrees. The outcome of this work with the ARC is the newly established Pharmaceutical Engineering Institute at Virginia Tech, one of whose specialties will be producing medications for the rare "orphan" diseases that generally provide too small a market to interest the larger pharmaceutical firms.

"I estimate we will need 100 kilograms [220 pounds] of protein C a year in the United States alone," Drohan comments. "Using conventional methods, we could make maybe two kilograms by using up our entire stock of blood, so you can appreciate what we're counting on those pigs to do for us."

Drohan and Martin MacPhee, an ARC colleague, are especially excited about the transgenic production of large quantities of human fibrinogen, perhaps the body's most efficient controller of catastrophic bleeding, especially when the fibrinogen is bolstered by the presence of an enzyme called thrombin, to catalyze its activity.

"Now," says MacPhee, "we have devised what looks like a bandage, but a very sophisticated one, layered with fibrinogen and thrombin, that can control bleeding and seal a wound in record time. We can also spray it on lesions—shark bites, automobile-accident injuries, extensive burned areas—where bandages can't do all the work. We can formulate it, too, as an expandable foam for other uses. So now we'll have enough fibrinogen for treating surgical and trauma bleeding. More than that, we can include antibiotics and antivirals in the mix to protect against infection. You can bet the Army is very interested."

Another transgenics company, probably the closest to bringing a product to the marketplace, is Genzyme Transgenics in Framingham, Massachusetts. That product, which is produced in the milk of transgenic goats, is a protein that regulates blood clotting. It is called anti-thrombin III, or ATIII, because it interferes with thrombin. It would be used in patients who have an ATIII deficiency, often those with liver disease, septicemia or burns, or who are undergoing surgical procedures. These uses are now standard in Europe and Japan, but not in the United States, where the product is currently used only to treat hereditary deficiency of ATIII.

Embryos of this mouse, a specialized laboratory strain, will be injected with DNA that will specify the production of an antibody useful in both research and disease treatment.

"We're betting," says Harry Meade, Genzyme Transgenics' research chief, "that ATIII will become the first commercial pharmaceutical produced from the milk of transgenic animals to be administered to humans."

Genzyme Transgenics, like Pharming, has agreements and collaborations with other companies, some abroad. Its transgenic mice and goats have produced in their milk various antibodies, proteins for potential cancer and malaria vaccines, possible therapies for diabetes, recombinant human growth hormone, human serum albumin and a drug for treating AIDS.

A catalogue of major pharming companies is not complete without PPL Therapeutics, headquartered in Edinburgh, Scotland. PPL is another firm that went through some tough

A piglet looks out into a brave new world. The sow and those of her offspring that are transgenic produce a hormone that can accelerate growth in mammals.

times early on but is now thriving. Its specialty has been transgenic sheep, pioneered at Edinburgh's Roslin Institute, out of whose advanced technology PPL was spawned. The celebrated Dolly, the first animal cloned from an adult mammalian cell, was the result of work done by Roslin's Ian Wilmut together with scientists from PPL. Now the sheep Polly has appeared, not only cloned but carrying the gene for human blood factor IX.

Cloning aside, though Genzyme Transgenics is a bit ahead in its clinical trials, PPL is not too far behind. Its trials are under way for sheep-derived human AAT, a protein that inhibits the action of elastase, an enzyme normally present in the lungs. This first series of trials is aimed at a therapy for cystic fibrosis, a disease whose deadly course is speeded by excess elastase.

But let's go back to square one on PPL's game board. Though its animal of choice, the sheep, was considered easier than the cow to develop transgenically, PPL ran into frustrations and unexpected high costs. After its transgenic ewes started to produce human AAT in 1991, the company thought it might find a promising market. AAT deficiency afflicts more than 20,000 people in the United States alone, and AAT until now has been both scarce and expensive. But the company was plagued by concerns about sanitation and safety: the danger of the product's being contaminated by viruses, for example. One particularly nasty threat was scrapie, a degenerative brain disease, which just may be the origin of mad cow disease in Britain. The prospect proved so worrisome that PPL went to New Zealand to find a scrapie-free herd, and flew 600 animals back to Edinburgh. PPL's first success was a transgenic founder ram that quickly sired seven females who produced half an ounce of AAT in each quart of milk.

PPL has also established a thriving transgenic center in Blacksburg, Virginia, near Bill Velander's operation at Virginia Tech. PPL has no sheep there but does have 18 founder transgenic cows raised in partnership with pharmaceutical company Wyeth-Ayerst Laboratories; they will be producing two nutritional products intended for premature infants and victims of the genetic disease phenylketonuria. Also at hand are the company's first transgenic pigs, which are intended not as pharm bioreactors but rather as providers of organs for transplant to humans. The company now maintains transgenic rabbits and mice there, too.

No sooner have we begun to get used to the idea of transgenic milk production when along come transgenic chickens! True, chickens don't give milk. But they do lay eggs. In South San Francisco, California, a start-up upstart named Origen Therapeutics is based largely on avian

transgenic technology developed by James Petitte at North Carolina State University in Raleigh. Its two ambitious aims: to produce chickens and eggs free of salmonella and other infections, and to produce eggs carrying pharmaceuticals. Will it work? Stay tuned.

An ironic twist brings us back full circle to mice, and to Bob Wall of the USDA. In the midst of his livestock work Wall and others decided to investigate a new idea: Could human proteins be produced in urine? Scientists elsewhere had discovered in 1995 a family of genes that are expressed only by cells lining the bladder's inner surface. Wall's team engineered those genes to produce impressive quantities of human growth hormone in the urine of mice. (Human growth hormone does exactly what it sounds like and is given to children who have unusually low levels of it. It costs $12,000 to $15,000 a year for a child, for three to five years of treatment. Adults who believe it has rejuvenating powers add to the demand.) It remains to be seen whether this feat can be duplicated in large animals. But urine does have some obvious advantages over milk: all animals in a herd could produce the protein, not just the females; animals start to urinate at birth but don't produce milk until maturity; and it's easier to extract proteins from urine than from milk.

The mammal that is experimenting with mixing and matching other mammals will have to confront the question of how much it wants to alter its own gene line.

When we talk about transgenic animals, the question inevitably arises: What of the animal in charge of all this activity? A group of geneticists called a meeting at UCLA early in 1998 just to talk about the possible consequences of germline genetic engineering in humans. We are becoming steadily more adept at germline manipulation in other animals and have begun to practice gene therapy on our individual selves. Gene therapy is entirely different from the germline engineering that produced transgenic animals. In gene therapy, the genetic alteration is not passed down to the next generation. It took years of ethical debate before gene therapy was allowed to proceed, yet even today, it has not been shown to work. But manipulating the germline in a way that affects future generations of human beings? Not long ago, it was looked on as a prospect too remote to warrant any special concern. No longer.

There are, as one would expect, extreme positions on the matter. One school of thought holds that, even if the day arrives when we are reasonably sure we know how to carry out human germline therapy safely and effectively, we still shouldn't do it; that it's immoral to risk inflicting unpredictable and irreversible damage on members of future generations.

An opposing school believes that, if we arrive at that day of reliable know-how, then we should proceed. In an article published in the *Kennedy Institute of Ethics Journal*, Ronald Munson and Lawrence H. Davis of the University of Missouri in St. Louis conclude that "medicine has a prima facie moral obligation" to develop and use human germline therapy. Some ethicists worry, of course, about sliding down the philosophical "slippery slope," using gene transfer to start improving healthy people and imparting to them characteristics that parents or others consider desirable—sliding, in a word, into eugenics.

Philosopher-physician H. Tristram Engelhardt, Jr., of the Baylor College of Medicine, contends that the capacity for human beings to change themselves or their offspring in positive ways cannot be dismissed or denied on any valid moral grounds. "In the end," he says, "humans will revise human nature."

Albert Rosenfeld is the former science editor of Life magazine. Theo Westenberger has photographed several cover stories for SMITHSONIAN.

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Pierre Bonnard

BY STANLEY MEISLER

The masterful modernist manipulated light, form and focus to create color-strewn scenes of everyday life

AS A YOUNG MAN, PIERRE BONNARD BURST ON the Paris art scene with an effervescent poster for champagne in 1891 and then remained a popular painter for the rest of his long life. Even when he gave up Paris for an almost reclusive life in the French countryside with his shy model and wife, Marthe, he could sell practically any painting he produced. The public loved his happily colored landscapes, his well-lit scenes of everyday indoor life, his erotic and classically posed nudes (mostly Marthe), and his penetrating self-portraits. Glittering samples of his work graced the walls of the important museums of Paris, London, Amsterdam and New York.

But he did have detractors, including the best-known artist of the 20th century, Pablo Picasso, who considered his older contemporary passé. "Don't talk to me about Bonnard," Picasso once told his mistress Françoise Gilot. "That's not painting, what he does. He never goes beyond his own sensibility. . . . He's not really a modern painter: he obeys nature; he doesn't transcend it. . . . Bonnard is just another neo-impressionist, a decadent; the end of an old

Bonnard's hallmark hues, flattened picture plane, and counterpoint of indoor and outdoor views enliven *Large Dining Room Overlooking the Garden*, 1934-35.

idea, not the beginning of a new one."

Although Bonnard had important defenders, such as the French master Henri Matisse, his work was overshadowed by the growing popularity of the Cubists and other avant-garde artists. When he died in 1947 at the age of 79, Bonnard was viewed by many critics as a primitive generator of color who mimicked the Impressionists and belonged far more to the 19th century than to the 20th. He had let all the revolutionary currents of his time pass him by. He was wonderfully pleasing but too simple to be counted as a master.

That view has changed over the past five decades; so much so that Bonnard is now widely regarded as one of our century's most complex and masterful painters, an artist who attempted in his later years to achieve a mystical, almost religious glory that harked back to the forerunners of the Italian Renaissance. And he did so with a host of modern, radical approaches. "Bonnard was not interested in competing with contemporary painters," Sarah Whitfield, a British art historian, told me in London recently. "He was interested in competing with the history of art."

Whitfield's assessment of Bonnard is reflected and demonstrated in a new exhibition of his life's work that she has organized as curator. This extraordinary Bonnard retrospective, which opened at the Tate Gallery in London in February and moved to the Museum of Modern Art in New York on June 17 (where it will stay until October 13), exposes Picasso's tirade to his mistress as hollow and foolish.

Pierre Bonnard was one of the stellar actors in the fin-de-siècle years of an exuberant, devil-may-care Paris. Born on October 3, 1867, to a sober bourgeois family that lived in the Fontenay-aux-Roses suburb of Paris, Bonnard seemed destined to follow a career much like that of his father, a ranking civil servant in the Ministry of War. But even while he earned a law degree and trained part-time in a dreary government office, he enrolled in art courses at the Académie Julian and the Ecole des Beaux-Arts.

His ambivalence about a career ended with his failure, perhaps an intended failure, to pass the civil service examination in 1888. He then gave up all pretensions of working for the government. Bonnard would now earn his keep as an artist. "I think that what attracted me then was less art itself than the artistic life," he would say later. "I wanted to escape from a monotonous existence."

Bonnard quickly became part of the avant-garde of his day. He joined a group of artists, mostly friends from the Académie Julian, who formed a movement of sorts and called themselves the Nabis (Hebrew for "prophets"). The Nabis—who included painters Edouard Vuillard and Maurice Denis and sculptor Aristide Maillol—were influenced by Postimpressionist painter Paul Gauguin and Symbolist poet Stéphane Mallarmé. Instead of trying to capture the effect of light and color in nature like the Impressionists, the Nabis would try to manipulate color and composition to evoke a feeling or a mood. The Nabis also looked on art as decorative and believed that their work should encompass certain crafts as well as painting and sculpture.

The earliest of Bonnard's 12 self-portraits (above) was done c. 1889 and is the only one where the artist, holding a palette and brushes, portrays himself as a painter. In *Man and Woman* (left), from 1900, Bonnard confronts the interplay of intimacy and distance.

Early photographs of Bonnard and an 1889 self-portrait (opposite) depict a shy, serious-looking young man with pince-nez eyeglasses. But these show only one side of him. An actor who shared a tiny studio with Bonnard and two other Nabi painters recalled him later as "the humorist among us." In his 1900 group portrait, *Homage to Cézanne*, Maurice Denis probably caught Bonnard best: a tall, bearded young man smoking a clay pipe, leaning on a cane, wearing a jaunty porkpie hat, and looking rather rakish despite his pince-nez.

In his 20s, Bonnard did all that any Nabi could want to do. His posters were so successful that they persuaded Henri de Toulouse-Lautrec, three years older, to try his hand at the genre. An admirer of Japanese wood-block prints, Bonnard also illustrated books, produced numerous sets of lithographs, and contributed to the new art and literary magazine *La Revue blanche*. He painted screens for living rooms and designed furniture, ceramics and stained glass, selling one design to Tiffany's of New York. And, of course, Bonnard painted, mostly everyday snapshots of his family in their garden at home, street scenes of Paris and voluptuous portraits of a nude.

The nude was Marthe. He purportedly spied her in 1893 stepping down from a Paris tram, followed her to the shop on Boulevard Haussmann where she sewed artificial pearls onto artificial flowers, and persuaded her to model for him. A gamine barely five feet tall, she told him her name was Marthe de Méligny and that she was descended from Italian nobility. She was 24 years old, two years younger than Bonnard, but told him she was only 16.

They would live together for a half-century, and he would capture her likeness in 384 paintings. He would not find out until their marriage in 1925 that she was really named Maria Boursin, and that she was the child of a poor provincial family. When she met Bonnard, her mother and sisters were still alive but had little contact with her. She sent them an occasional postcard and met a sister from time to time in Paris but never revealed her address. The family knew she lived with a painter but did not know his name.

Judging by Bonnard's paintings, Marthe, though short in body, was long-legged, shapely and round-faced. Far from beautiful, she caught his eye with pleasing, coquettish features. In his works, her most indolent poses become exceedingly erotic. But she puzzled Bonnard's friends. One described her as brandishing "the wild look of a bird," always "fluttering" near Bonnard. She was reclusive, and tried to keep him away from his friends. She was paranoid, fearful friends would steal his ideas.

Their relationship was strange and troubled. Bonnard testified to this with a painting in 1900 called *Man and Woman* (opposite). A screen divides this bedroom scene almost into halves. A nude Marthe, bathed in light, sits on the bed to the left of the screen, mostly immersed in herself, nonchalantly playing with two kittens; a lanky, nude Bonnard, his face partially obscured by shadows, stands to the right, far apart from the woman so near.

In the dawn of the 20th century, Bonnard turned his

Luminescent tiles surround the artist, then in his mid-70s, in a 1943 self-portrait (above). Reflected in a mirror, eyes averted and obscured, he remains elusive. Vivid patches of color define the trees, fields and hedges in *Normandy Landscape*, 1920 (right).

In Young Women in the Garden, a golden, red-cheeked Chaty fills up much of the center of the canvas. Time passes before you notice a second woman, a pale and bland Marthe, emerging partially in the lower right-hand corner.

back on Paris. He did not forgo it completely; he kept a studio and an apartment there. But he and Marthe spent more and more time in the country, touring Normandy, the Mediterranean coast and various spas. In 1911, he bought his first car, a Renault, making forays even easier. He soon adopted the routine of spending no more than two months a year in Paris, not to paint, but to attend to business with his dealers and to catch up with old friends. "In Paris I am a critic," he told a friend. "I can't work there. There is too much noise, too much distraction."

Paris had turned less congenial to Bonnard after the turn of the century. He and his colleagues had started to reexamine the Impressionists and attempt to extend their use of color in symbolic rather than natural ways. But painters like Picasso and Matisse were leading the avant-garde in different directions. "Progress came upon us faster than anyone expected," said Bonnard many years later, "and the public was ready for Cubism, and even for Surrealism, before we had realized our intentions completely. We were left, so to speak, dangling in mid-air."

Marthe also drew him from Paris. Ill and subject to fits of depression, she demanded the kind of tranquillity and rest that was not possible in the hurly-burly of the capital. Bonnard's friend, the publisher George Besson, wrote that, though her demeanor was birdlike, "her voice croaked rather than sang, and was often hoarse and breathless." Friends thought she suffered from a nervous disorder and tuberculosis or asthma. At times Bonnard would become disheartened. "For quite some time now I have been living a very secluded life," he wrote Besson in 1931, "as Marthe has become completely antisocial and I am obliged to avoid contact with other people. . . . It is rather painful."

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In The Boxer, *painted when he was 64, a weak and weary Bonnard flails out impotently at his fate.*

Comments like these are shafts of light into a hidden life. Bonnard was a secretive man. For many years, he kept diaries that tell us almost nothing personal; they were obviously designed to jog his memory while painting. Taking along a pocket agenda on his morning walks, he would note the weather—fair, clouds, rain—and sketch an idea in pencil. Sometimes he would add a shopping list and, occasionally, an aphorism. "He who sings is not always happy," he wrote once. Sarah Whitfield believes that "of all the great 20th-century painters, he is the least known."

In 1914, when he was 46, Bonnard experienced great self-doubt and decided to reassess his direction and goals. "I have sent myself back to school," he told his nephew. "I want to forget all I know. I am trying to learn what I do not know. I am restarting my studies from the beginning, from ABC." This period of self-examination led to his most complex and carefully wrought paintings.

In transforming his art, Bonnard, even while painting what seemed merely to be intimate and color-strewn scenes of real life, took on the challenge of the 20th century to create works that broke with the past. The critic John Russell has written that Bonnard's later paintings showed "qualities of daring and invention" that outshined the fantasies of the Surrealists, the color of the Fauves and the multiple viewpoints of the Cubists.

Bonnard took the traditional idea of color and turned it on its head. Academics taught that an artist drew his or her idea or story and then gave it sensation by adding color. But Bonnard maintained that "drawing is sensation. Color is reasoning." In short, the colors themselves could carry the narrative or meaning of a painting. The colors themselves could please in an almost abstract way.

He was even more daring with focus. Painting mirrors and French windows to break up his compositions, Bonnard would place three or more focal points in a canvas to attract the eye of the viewer. In his diary, he called painting "the transcription of the adventures of the optic nerve." He wanted his paintings "to show what one sees when one enters a room all of a sudden." It could take some time before the major element of a painting emerged from the shadows and captured a viewer's gaze. In the catalogue for the current exhibition, John Elderfield, the Museum of Modern Art's chief curator and a consultant for the show, makes the case that some parts of a Bonnard painting come into sharp focus only when seen with the corner of the eye.

Bonnard also tried to capture memory in painting just the way his contemporary, Marcel Proust, was capturing memory in literature. Bonnard would sketch, but rarely paint, from real life. He would tack up a canvas on the wall of a room and paint from memory, aided by sketches and notes. He believed that if a model or object remained in front of him as he painted, it would interfere with what he wanted to create—his memory of the moment when that model or object was most beautiful to him.

Color, focus, memory, combined to produce the great Bonnard paintings. "The more one looks at them," Elderfield told a group of reporters recently, "the more odd things begin to happen. Bonnard created a new kind of narrative. If you spend time in front of a Bonnard painting and watch, objects come in and out of focus. It is as if everything in the world is elusive."

A few years after his midlife crisis in art came a midlife crisis in his love for Marthe. Bonnard tried to break from the woman who had become both his muse and his millstone. He had at least two other affairs, the last and most important beginning about 1918 with a statuesque blonde named Renée Monchaty, a young artist known as Chaty to both Marthe and Bonnard. In 1921, he and Chaty spent two weeks together in Rome, where they told her parents of their plans to marry. Bonnard was 53 then; Chaty was 27.

But Bonnard could not bring himself to leave Marthe, and in August of 1925 he married her in the city hall of Paris' 18th arrondissement before two witnesses—the concierge of his Paris apartment building and her husband. Bonnard and Marthe had lived together for 30 years. He

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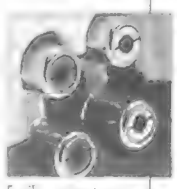

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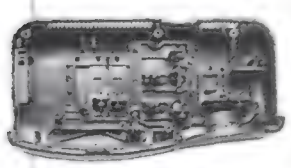

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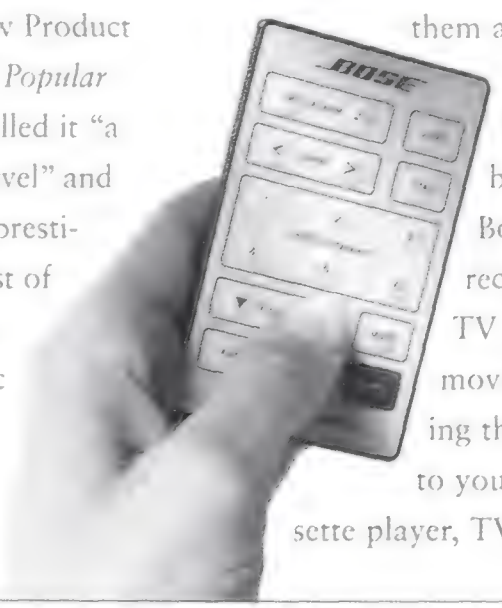

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did not inform his family of the marriage. A month later, a forlorn Chaty killed herself in her Paris apartment. According to one account, she was found in bed, surrounded by white lilacs. According to another, she was found in the bathtub.

Bonnard left behind a remarkable record of the affair with Chaty in *Young Women in the Garden*, painted in 1923 and reworked in 1945 and 1946 after Marthe's death. A golden, red-cheeked Chaty fills up much of the center of the canvas. Time passes before you notice a second woman, a pale and bland Marthe, emerging partially in the lower right-hand corner. Although the main focus of the painting, Chaty looks strangely flat until you move alongside the right edge of the canvas and look up to view her from the vantage of Marthe. Chaty is then transformed into a three-dimensional, alive, dominating creature, the overpowering rival seen by the distraught and sickly Marthe.

In *The White Tablecloth*, c. 1926, a figure emerges from the patterned color to the far right of the uptilted tabletop.

In the last decades of his life, Bonnard produced an impressive variety of paintings. Perhaps the most compelling were his uncanny canvases depicting landscapes and interiors at the same time. By using windows, doors and porches, Bonnard could show both the inside rooms and outside gardens of the homes he rented or owned in the French countryside. These compositions delighted viewers with extravagant color. In *The Open Window* (1921), for example, the room is orange and purple, while the window opens onto gardens that are blue and green. Bonnard manipulated light in his inside-outside paintings, too, sometimes making the interiors brighter than the landscapes.

Bonnard also produced numerous paintings of Marthe washing endlessly in a bathroom. Her need for so much bathing was not surprising; the French have long believed in the healing powers of water. Although these paintings superficially resemble the bath portraits of the Impressionist Edgar Degas, Bonnard was not trying to capture any natural moments. Marthe, in fact, never appears to age in his paintings. Even when she nears 70, she still possesses the body that excited him a half-century earlier. Bonnard also adjusted Marthe's poses to resemble the poses of his favorite Greek sculptures in the Louvre.

In his self-portraits, another genre of his later years, Bonnard did not hide his age the way he hid Marthe's. In fact, he cruelly painted himself as even more frail than he seemed in photographs of that time. In *The Boxer*, painted when he was 64, a weak and weary Bonnard flails out impotently at his fate. The self-portraits at ages 71 and 73, and again at 76 and 78, make him seem even more confused and fearful of approaching death.

Since the 1920s, Bonnard had corresponded with Henri Matisse. Matisse could be playful. He even sent Bonnard a postcard from Tahiti showing a Polynesian maiden. "A pretty girl for you!" he wrote. Bonnard, on the other hand, was always more formal, polite and respectful. Yet their letters are fired by genuine warmth and a meeting of the minds on art. After Matisse returned from installing his mural *The Dancers* in the museum of Dr. Albert Barnes near Philadelphia, Bonnard wrote, "Surely painting is an achievement only if you give yourself up to it entirely. I think we understand each other on this point." Although some critics tended to place them in different artistic generations, Bonnard was only two years older than Matisse.

Their correspondence intensified during World War II, even though they lived less than 20 miles from each other on the Mediterranean coast. Bonnard had purchased Villa Le Bosquet, a house overlooking Cannes, in 1926 and remained there during the war. Matisse lived in Nice and later in nearby Vence. But the shortage of gasoline, the restrictions of wartime travel, the distaste for encountering German soldiers, and the illnesses of men in their 70s kept them apart for long stretches of the war.

Bonnard had many complaints: the shortage of coal, the lack of meat and cheese, the bombing by the British, infections of the eye, the frailty of Marthe. Nevertheless, he wrote Matisse, "my work is not going too badly, and I dream of seeking the absolute." But Marthe weakened and her lungs began to fail. Her heart stopped in January 1942. "You can imagine my grief and my solitude," Bonnard wrote his friend, "filled with bitterness and worry about the life I may be leading from now on." He gave the news of Marthe's death to few others.

Marthe figured large in his final pursuit of the absolute. Among Bonnard's last paintings are portraits of Marthe ly-

ing motionless beneath the water of a bathtub (below). Sunlight has transformed the tiles of the bathroom into purple and yellow and green and blue and orange, evoking images of ancient tombs with glittering mosaics.

Curator Sarah Whitfield, discussing these paintings with me, recalled that Bonnard and Matisse looked on the 14th-century Italian frescoes of Giotto as the summit of art and talked of trying to set out on "the road leading to an equivalent." With his bathtub paintings, Whitfield believes, Bonnard moved far down the road. "These are as close as any 20th-century painting to an equivalent," she said. "Bonnard has aroused the deepest emotions that human beings experience: death, loss, memory, joy and renewal."

By 1947, Bonnard had become too frail to wield a paintbrush. At the Villa Le Bosquet, the bedridden painter asked his nephew, Charles Terrasse, to alter his last painting, *Almond Tree in Blossom*. A patch of green ground was wrong, Bonnard decided, instructing his nephew to change it to gold. Bonnard died a few days later on January 23, 1947. He was 79 years old.

A year after his death, the prestigious French art magazine *Cahiers d'Art* published an editorial headlined, "Pierre Bonnard, Is He a Great Painter?" The writer, Christian Zervos, a longtime Picasso promoter, concluded no. An angry Henri Matisse wrote across the top of the editorial in his copy of the magazine: "Yes! I certify that Pierre Bonnard is a great painter, for today and assuredly for the future." He then signed and dated his testament, an assessment that prevails in the art world a half-century later.

Stanley Meisler, a former Paris correspondent for the Los Angeles Times, *last wrote for* SMITHSONIAN *on pirated Romanesque art.*

An ethereal Marthe appears almost consumed by the jewel-like light in *Nude in the Bath and Small Dog*, 1941-46.

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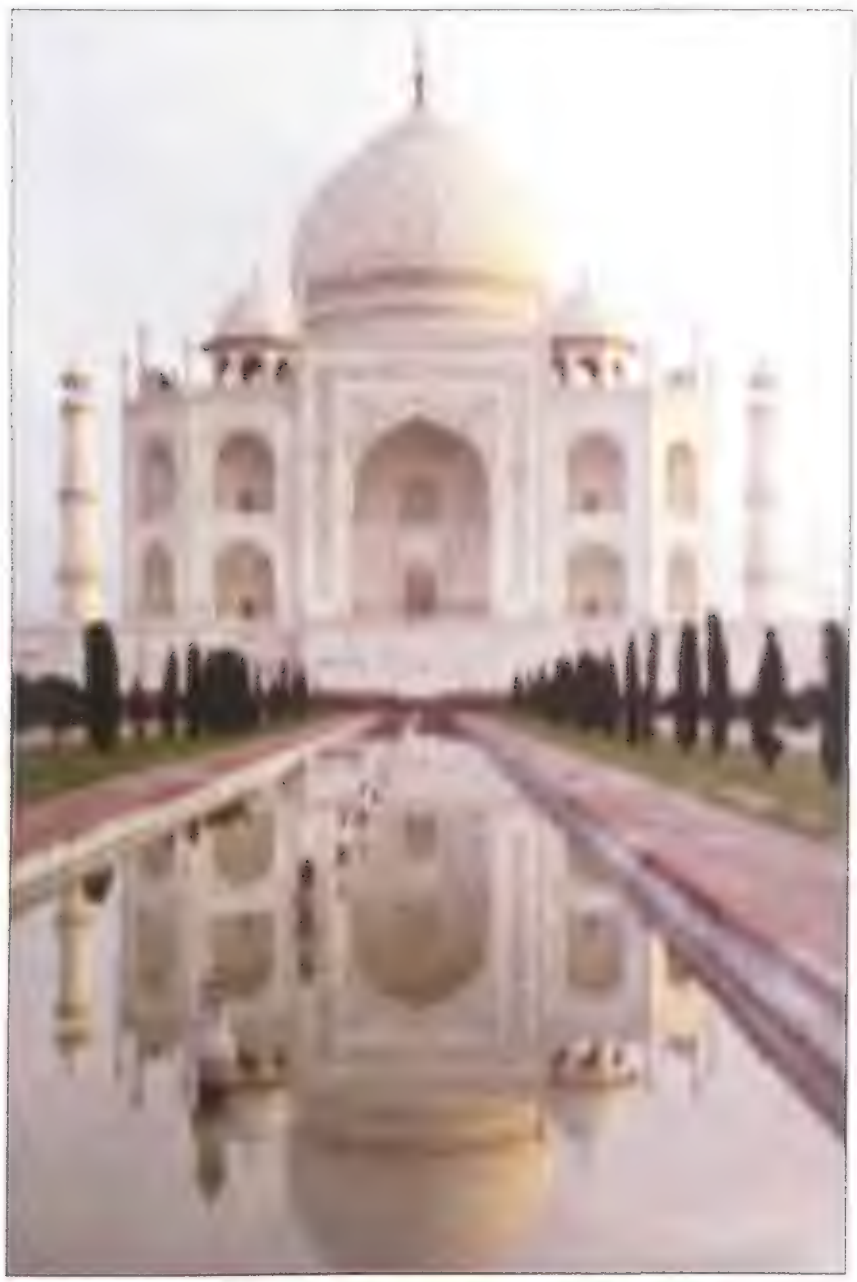

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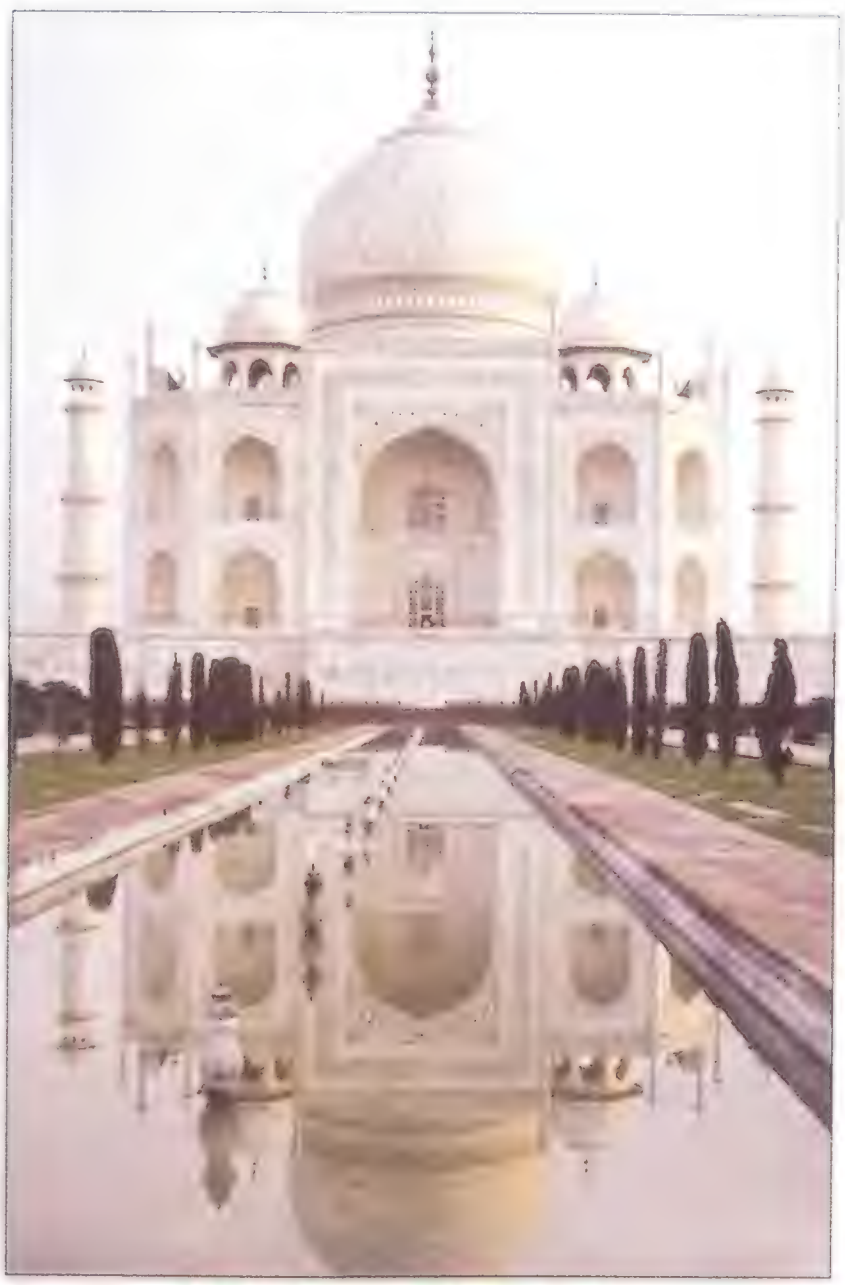

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The Man Who Dreamed Up MADELINE

A dashing nonconformist himself, Ludwig Bemelmans conferred a winning waywardness on his headstrong heroine

BY ROBERT WERNICK

CREATORS OF THE ETERNAL IMAGES of children's books have usually been quiet, retiring, very private individuals, such as the Rev. Charles Dodgson, who created Alice; or A. A. Milne, who created Winnie-the-Pooh; or Charles Schulz, who is still creating Charlie Brown and his crew. A very different sort of fish was the creator of Madeline. Almost all children and parents in today's America are well acquainted with the physical Madeline, who is a little convent-school girl with a blue dress and a yellow hat and a mischief-making smile. (And she is about to make her appearance in *Madeline* the movie, released this month by TriStar.)

But only old-timers can recall that spiritually she is a mirror image of Ludwig Bemelmans, a freewheeling, free-spending, freelance writer-artist of the mid-century, a man who was always on the go, always getting into and somehow out of impossible situations, a man about any town you can think of, New York or London or Paris or Quito, a boulevardier and a raconteur, everyone's idea of a pure product of old Vienna, though in point of fact he spent very little time there. Born in 1898, he was the child of a Belgian father and a German mother, and lived the first six years of his life in pampered solitary ease in an old house in a park on its own little island, across a lovely lake from the hotel his father owned in the Austrian resort of Gmunden.

Those six years he shared with a big handsome swan and a governess called Mademoiselle—which he pronounced "Gazelle"—who combed his golden curls and sang French songs to him and called him her sweet little cabbage, in an endless wonderland of mist and flower and mountain. On rare occasions his father came by to give him a toy motorcar or some other plaything, but his father saw no point in talking to a boy before he was 17 and could understand what he was being told.

Once his father had him dressed up as an angel and slung on a pulley to the top of a Christmas tree in the hotel dining room, but the noise and the flickering candles made the child sick and he was sent away in disgrace, and could run back to his island and his Gazelle, and watch the ever-changing colors of the world.

MADELINE AND BARBARA BEMELMANS

Bemelmans (above right, in his New York studio with daughter Barbara, circa 1939) sketches the original Madeline drawings. The tale of "twelve little girls in two straight lines" is based on his mother's memories of convent-school life.

Then one day, abruptly, the happy times ended. His father ran away, Gazelle ran away (it is not clear from his account whether they ran away together) and he was being clothed and combed by a beautiful stranger, his mother. Oh why, he asked God in prayers, had his father not run off with his mother and left him alone with Gazelle? From the paradise of Gmunden on the Traunsee where he had spoken only French, he was thrust into the purgatory of Regensburg on the Danube in Bavaria. In that tight, cold, clannish city, he would remain always something of an outsider, though his grandfather owned the brewery whose smells impregnated the streets.

He was thrown out of the schools they sent him to, for being "unruly, impertinent, never serious, always late, and [keeping] bad company." Then they sent him back to Austria, to the beautiful Tyrol, to live with an uncle who owned a chain of luxury hotels in mountain resorts frequented by royalty. This uncle, who called him affectionately *Lausbub* (literally, "louse boy," or "little rascal"), first gave him a horse on which he could ride to surrounding villages but then determined to teach him the hotel business.

By the time he had been fired from each of the hotels in turn, it was apparent to his most lenient relatives

that he could be on the road to ruin. "Disgrace, disgrace, disgrace," said his mother to him, and though she added, "Everything will come out all right in the end, Ludwig," the family decided the only thing to do with the Little Louse was to put him, age 16, on a ship going to New York. Perhaps there the standards in the hotel business would be less high.

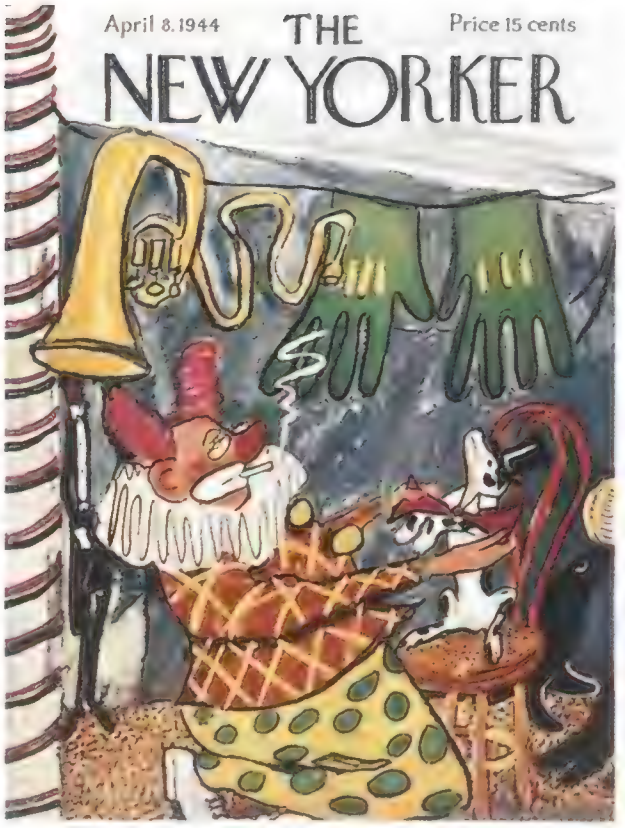
He got a job as busboy at the Hotel Astor. He had worked his way up to a better job at a fancier hotel, and had a small fortune of $250, when he fell in love with an actress. She was playing the noblewoman in a German operetta called *Hoheit tanzt Walzer* (Her Highness Waltzes). In Act I, Her Highness comes in a carriage to a little Austrian inn where she finds a prince living incognito, the very prince with whom she had been passionately in love since they first laid eyes on each other at the age of 5 in the park of the archduke's castle, and they sing a duet full of tender longing. Now or never was the moment for young Ludwig to make his presence known to her.

He ran out of the theater, called a taxi and drove up Fifth Avenue till he found a fancy florist's shop where he could buy, for $25 (about $400 in today's money), not any old bouquet but a whole four-foot-high rose tree, which he brought down to the theater in the middle of Act II. He handed his offering over to two girl ushers with instructions to present it to the princess at the end of her next aria.

He got to his seat and unrolled his program, only to learn that the scene had been changed to the archduke's park: time had rolled back 20 years. The part of the princess was being played by Lisl Stolz, age 6. The rose tree was already on its way down the aisle. It was too late for him to do anything but run away, before it was ceremoniously presented by the conductor to the princess. She opened the note attached to it, announcing his love and asking her to dinner at Luchow's after the performance.

Such falls from grace were to form a pattern ruling all his full and peripatetic days: promises of serenity and fair prospects, followed by bleak and sometimes grotesque, sometimes merely ridiculous, disaster. Bemelmans took things always in stride, with a fatalistic good humor. His life, at least his life as he would represent it in a series of popular books, was a tale sung by Franz Kafka to the tune of *Merry Widow* waltzes. He once wrote his editor explaining that he had devised a line that would stand ready to be incised on his tombstone: "Tell Them It Was Wonderful." The title actually was used for a collection of his stories and drawings, published nearly a quarter-century after his death in 1962, of cancer.

His wife Madeleine, "Mimi," had a characteristically pert, curt comment



He once wrote to his editor explaining that he had devised a line that would stand ready to be incised on his tombstone: "Tell Them It Was Wonderful."

In addition to his books, a number of projects engaged Bemelmans, including a 1947 mural for the Carlyle Hotel bar (left) and covers for the *New Yorker* (above).

on the title: "Sometimes it was. Sometimes it wasn't." Mimi had every reason to know what she was talking about. A student at Barnard when she married him in 1934, after brief careers as a nun and an artist's model, she was always ready to swing alongside him in whatever direction he took.

By that time, Bemelmans was making a go of it as an artist and writer. He had begun selling illustrations to advertising agencies and went on to attract magazines as his clients.

One of her vivid memories is of the time, during the 1930s, when they were on a train going from Germany back to Austria, and the train was held up a long time at the border. It turns out that an informant, who had spotted Bemelmans the day before, had reported him for subversive behavior. The previous afternoon, Mimi and Ludwig had been sitting in a beer garden in Berchtesgaden, where a big window allowed a view upward to Hitler's Eagle's Nest retreat on the mountaintop. The radio began blaring a Hitler speech, and all eyes in the establishment turned automatically to the window in mute homage to the beloved Führer. Just under the window was Ludwig Bemelmans, with a cigar stub between his upper lip and his nose, giving a mock-Nazi salute.

Yet another misstep would serve to besmirch his reputation even more. That night, their last at a Berchtesgaden hotel, Mimi had painted her toenails. As a joke, she painted her sleeping (and snoring) husband's toes in the same shade.

That prank came back to haunt Bemelmans after the authorities yanked him off the train for questioning and threw him in jail. When they strip-searched him and came upon the toenails, they cried in fury, "So that is the kind you are. We'll show you what we do to your kind." The police threw him into a black hole full of whomever they had picked up recently in their search for decadence and degeneracy. There he would spend many uncomfortable hours before an American vice-consul turned up to negotiate his release and told him to flee the country.

He was soon back in America and turning out covers for the *New Yorker*, no worse for wear. He also wrote many articles about his intercontinental adventures for such fashionable magazines as *Town and Country*, *Vogue* and *Holiday*. He published dozens of books, wrote a script for MGM, sold paintings at upscale galleries. He was always surrounded by beautiful objects and rich friends. He stayed in Ritz-class hotels, and his daughter, Barbara, rode in Central Park with the daughter of Meyer Lansky, the cofounder of Murder, Inc.

But like many other famous writers, he found it all but impossible to hold on to any money he made. And his correspondence, like James Joyce's, revolved largely around the need for cash. Sometimes these quests were successful. Sometimes they were not. They were always imaginative. After the success of his first four Madeline books, all set in Paris, he persuaded his publisher that the only way he could prepare for the next title, *Madeline In London*, was to spend six months at posh Brown's Hotel. (His publisher would, of course, foot the bill.) And so it was done.

He had a habit of writing letters describing his woes in long sentences that snaked around bright watercolor

The Madeline craze has created a flood of spin-offs, including gear from pails to puzzles (above) and now the TriStar feature film (right) based on the book.

In his world, people flirt, fly kites, saunter around; no one does a lick of work, except the cop who is chasing the jewel thief across the Place Vendôme.

sketches and ended up with a brief statement: "I need for these calamities." When he really needed something, he would fill in the blank with an arbitrary figure, say $500.

The Bemelmans life, as portrayed in the Bemelmans books, took place in a bright, softly colored landscape of beautiful trees and beautiful monuments. It is a landscape very much like the Paris in his books—and the idyllic Central Park portrayed on the walls of what is now known as the Bemelmans Bar at the Carlyle Hotel in Manhattan. In his world, people flirt, fly kites, saunter around; no one ever does a lick of work, except the cop who is chasing the jewel thief across the Place Vendôme.

As if on schedule, reality would periodically intrude, as when Louis B. Mayer dictated a memorandum to his staff, "Never hire the SOB again—unless we really need him." A new and a brighter future was always, from Bemelmans' vantage point, just around the corner.

While Bemelmans was writing an article about Parisian criminals and cops in the underworld around the Place Pigalle, his eye was caught by an old ruined house at No. 4 rue de la Colombe on the Ile de la Cité, the island in the Seine on which stands the cathedral of Notre Dame. Built in 1225, the house had been frequented in its time by kings' mistresses and vagabond monarchs. He saw the possibilities of turning it into a garden spot, with flowering vines, and a duplex studio for him upstairs, and downstairs an elegant bistro. (And he could save money by getting all his own food and drink wholesale.)

He found an underworld lawyer and an amiable architect, who promised to get the plans through the minefield of government regulations dealing with ancient buildings. Then he went off to make some money in America, telling the architect to at least get indoor plumbing installed by the time he came back. Work began at once on this project but was halted when a French official discovered that to extend pipes from the house to the

sewers of Paris, 200 yards away, would involve drilling holes through a rock foundation that was also the foundation of Notre Dame.

Though this foundation had held firm through the thud at its doorstep of uncounted millions of human and animal feet, cart wheels, automobile tires and tank treads, through eight centuries, the pressure of a pneumatic drill so close by might cause the cathedral to shudder and whole towers to come crashing down. So the work had to be done by two men with picks and shovels, filling canvas bags with debris. By the time the owner returned they had filled 260 sacks at $100 per sack; he was broke again.

Amid this disappointment, however, came one episode of unmitigated success. One day he was happily bicycling down the wrong side of a road on the Ile d'Yeu off the coast of Brittany, with four lobsters in a bag slung over his shoulders, and his hands in his pockets, when he rounded a curve. At that moment, he managed to collide with the island's single motor vehicle, a baker's delivery van. Bemelmans was catapulted into a bramble bush. Since the baker insisted that French law required the vehicle involved in an accident to remain on the spot till the police investigated, Ludwig had to walk a mile to the hospital to get his wounds tended.

He was put in a narrow bed that reminded him of stories his mother used to tell him of her youth in a school kept by English nuns, where all the little girls' cots were lined up in two straight lines. On the ceiling above him was a stain that looked like a rabbit. In the next room there was a girl recovering from an appen-

Unfazed by sights that cause her compatriots to quail, our heroine exhibits her signature sangfroid: "To the tiger in the zoo Madeline just said . . . 'POOH, POOH!'"

dicitis operation. One idea led to another. When he had recovered and was back in New York, he began one evening at Pete's Tavern on East 18th Street to sketch out the plot of what would be the first of his six books about Madeline, the one in which she shows off her appendicitis scar.

There is no secret to Madeline's charm. She embodies every child's (or adult's) desire to break the tiresome rules of life and every child's (or adult's) hope to get away with it. Madeline does both, quite naturally, without moving a muscle of her face. She may fall into the Seine while she is recklessly promenading along the railing of a bridge; a dog jumps in to save her. She may push into the middle of a pack of maddened dogs to save a cat that her impossible chum Pepito, son of the Spanish ambassador, had marked out for slaughter. Both Madeline and the cat she rescues come out without a scratch, while Pepito is bandaged from head to toe and, conscience-stricken, turns vegetarian out of sheer remorse. She runs away with Pepito and they are both sewed up into a lion's skin to perform in a gypsy circus. She rides a horse that insists on taking part in a parade of the Horse Guards in London. Whatever she does she ends up, eventually, sleeping at the end of one of the two straight lines of cots that she shares with 11 other girls, under the benevolent eye of Miss Clavel.

The year of Madeline's appearance was 1939, just three years after the appearance of Munro Leaf's *Ferdinand the Bull*, another icon of youthful nonconformity, as much unlike the orthodox Hemingwayan idea of a brave bull as Madeline was unlike the image mothers have of young ladies who are sent off to exclusive schools. Ferdinand, like Madeline, has kept on appealing to children of the passing generations, however unfamiliar those images of Spanish bullrings and the Luxembourg Gardens may be to young eyes brought up on dinosaurs and Butthead. Both sets of books are still in print, still selling extravagantly. For Viking Children's Books, the Madeline titles, translated into 12 languages, have sold more than 8 million copies since first publication.

Both Madeline and the cat she rescues come out without a scratch, while Pepito is bandaged from head to toe and, conscience-stricken, turns vegetarian out of sheer remorse.

Madeline, however, has pulled ahead in the commercial derby. Since the early 1980s, a dizzying array of Madeline-based products have appeared. In America, and a number of other countries, children can brush their teeth with Madeline toothbrushes and spend a rainy day with Madeline paper dolls. Mimi and daughter Barbara have themselves been amazed by the flood of videos, CDs, puzzles, wristwatches, backpacks and so on.

The Madeline doll, first mass-produced in 1990, is one of the best-selling dolls of modern times. The steady income that eluded Ludwig Bemelmans for so long has become a fixed proportion of the gross national product. As his mother pointed out to him long ago, things were bound to work out in the end.

Robert Wernick, a frequent contributor, wrote recently about the Spanish Civil War.

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The winter of 1776-77 proved a nightmarish ordeal for some 2,500 men garrisoned at Mount Independence, many of whom froze to death.

In Vermont, A Valiant Stand For Freedom

BY RICHARD WOLKOMIR

ILLUSTRATIONS BY GREG HARLIN

DAVID STARBUCK PARKS HIS PICKUP BY THE new visitors' center, which is shaped like an upside-down bateau drawn up from Lake Champlain. Beyond lie only frost-nipped meadows and pinewoods. "Mount Independence is the most intact site of the Revolution," Starbuck says. "So much is still sitting right here on this mountain."

A crow's cawing is the sole other sound. It is November; the visitors' center is closed for the winter. Miles of white clapboard farmhouses and red dairy barns lie between this promontory, jutting into Lake Champlain from the Vermont shore, and Orwell, the nearest village.

"This site was so big," Starbuck says. "And so unknown." He starts up the trail, under gray clouds. Sometimes a beam of harsh sunlight slants down, illuminating a cedar grove or a zigzag rail fence. White pines shiver in a polar wind. "It's the suffering of the men that's the most important here," Starbuck muses, as he trudges up the path to the hospital site. "They came here, to the Mount, after the sieges of Montreal and Quebec, and the number of sick and wounded was incredible."

AT MOUNT INDEPENDENCE, HEROIC AMERICANS HELD OFF THE BRITISH IN A CONFRONTATION THAT CHANGED THE COURSE OF THE REVOLUTIONARY WAR

In regiments from New Hampshire, Massachusetts, Connecticut, New Jersey and Pennsylvania, more than 10,000 soldiers, approaching the population of Boston, gathered here in the summer of 1776. They dug in atop this hill, roasting beef and perch over fires, building a star-shaped fort and barracks and gun batteries, manning stone lookout stations, winching powder kegs and cannon up 100 feet from the lake below with a giant crane. But now David Starbuck, wearing plastic-rimmed glasses and jeans and machine-stitched boots, walks through Mount Independence State Historic Site, which is also a cow pasture. "This is Vermont," Starbuck shrugs. "Why pay people to cut brush when holsteins do it for free?"

Starbuck is a professor of archaeology and anthropology at New Hampshire's Plymouth State College and staff archaeologist at the Saratoga National Historical Park, 60 miles to the south, in New York. When the state of Vermont, prodded by citizen enthusiasts, decided to do something about Mount Independence, largely forgotten since its burning by Hessians (German mercenaries fighting for the British in the Revolutionary War), state preservationists asked Starbuck to excavate.

He stands under pines, contemplating a line of stones. It was the foundation of the two-story hospital where men who would never make it home died. "All the time we were dig-

ging here I had a sense of those ordinary soldiers, working and suffering," Starbuck says. He has searched, so far in vain, for the site where the amputated legs and arms are buried.

Starbuck excavated over three summers, preparing for Mount Independence's opening on July 27, 1996, as the country's newest Revolutionary War park. Hundreds of volunteers—students, history buffs, local enthusiasts—worked at the site, taking up trowels and sieves, sleeping in classrooms at the Orwell Elementary School, exulting with the exhumation of each foundation stone or musket ball or wine-bottle shard or button.

In the end, they dug up a story. It featured stars of the Revolution, from Ethan Allen to Benedict Arnold. But the story also had thousands of bit players, like the British soldier in Gen. John Burgoyne's army who eventually went over to the Americans, and whose son fathered the artist James McNeill Whistler. It was a tragedy. "The diaries describe eight to ten men freezing to death on the most bitter winter nights," says Starbuck. "It was worse than Valley Forge." In the

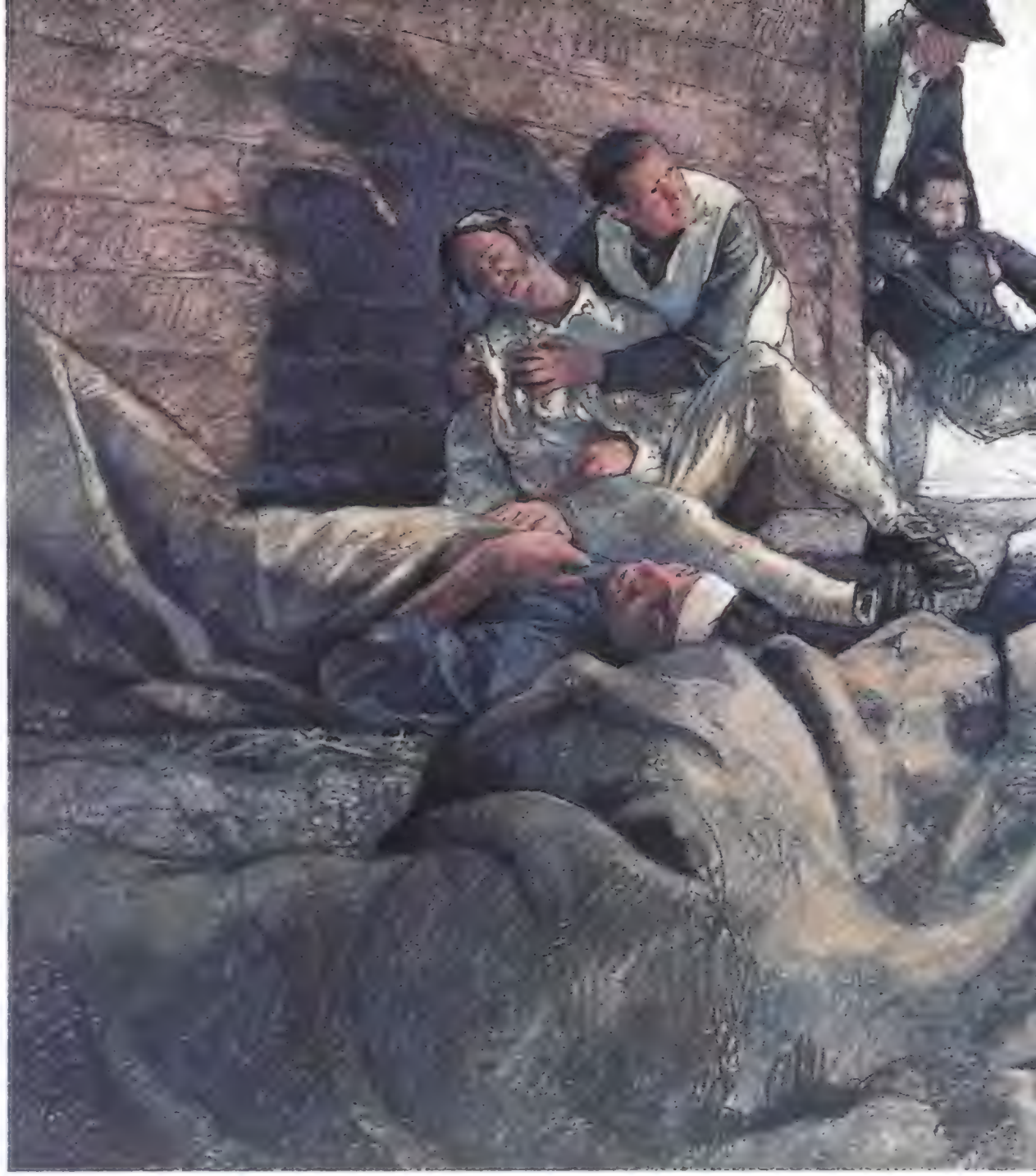
In June 1777, a massive British fleet bore down on Lake Champlain to the Mount. The patriots retreated, but they had held off the enemy for a fateful year.

beginning, however, there was only Benjamin Franklin in a boat.

APRIL 1776

America's most famous citizen, Benjamin Franklin, is sailing up Lake Champlain in a 36-foot bateau. Only an awning protects the septuagenarian from the frigid spray. Franklin is traveling to Montreal, on a commission with Samuel Chase and Charles Carroll, to rally French Canadians to the American cause. But the commissioners pass by Fort Ticonderoga, and they eye the old bastion on the New York shore critically.

The French built the redoubt where the lake narrows in the south to just a quarter-mile wide. "Carillon," they called the fort, because a nearby rapids sounded musical. It was to block British attacks up the water highway that runs from New York City up the Hudson River to Lake George, then up Lake Champlain, and on to Canada. In the summer of 1758 the Marquis de Montcalm, holding Carillon with just 3,600 French troops, turned back 15,000 British attackers. By 1775, at the start



During the winter, the fort's hospital, described as a "House of Carnage" by one observer, was without beds or medicine. "It was," says one historian, "worse than Valley Forge."

of the Revolutionary War, the fort, now in British hands and renamed Ticonderoga, had decayed.

Just after the battles at Lexington and Concord, guerrilla Green Mountain Boys, led by Ethan Allen and Benedict Arnold, captured Ticonderoga. Next the Colonials, led by Arnold and Gen. Richard Montgomery, invaded Canada. They took Montreal and besieged Quebec, where Montgomery was killed and Arnold wounded. Now, in the spring of 1776, the American forces in Canada are teetering, short of ammunition and supplies, decimated by smallpox. If they retreat, the British will counterattack down Lake Champlain. To the American dignitaries sailing northward, it seems doubtful that decrepit Ticonderoga could stop a British army.

But across the lake, on the Vermont shore, they see a striking promontory, its cliffs rising Gibraltar-like from the water. They mark it.

Weeks later, the contingent returns to Philadelphia; they urge Congress to fortify the promontory, known to local settlers as Rattlesnake Hill. Gen. Philip Schuyler, commander of the northern department, is equally enthusiastic. He writes to George Wash ington that the site is "so remarkably strong as to require little labor to make it tenable against a vast superiority of force, and fully to answer the purpose of preventing the enemy from penetrating into the country south of it." Congress concurs.

JUNE 1776

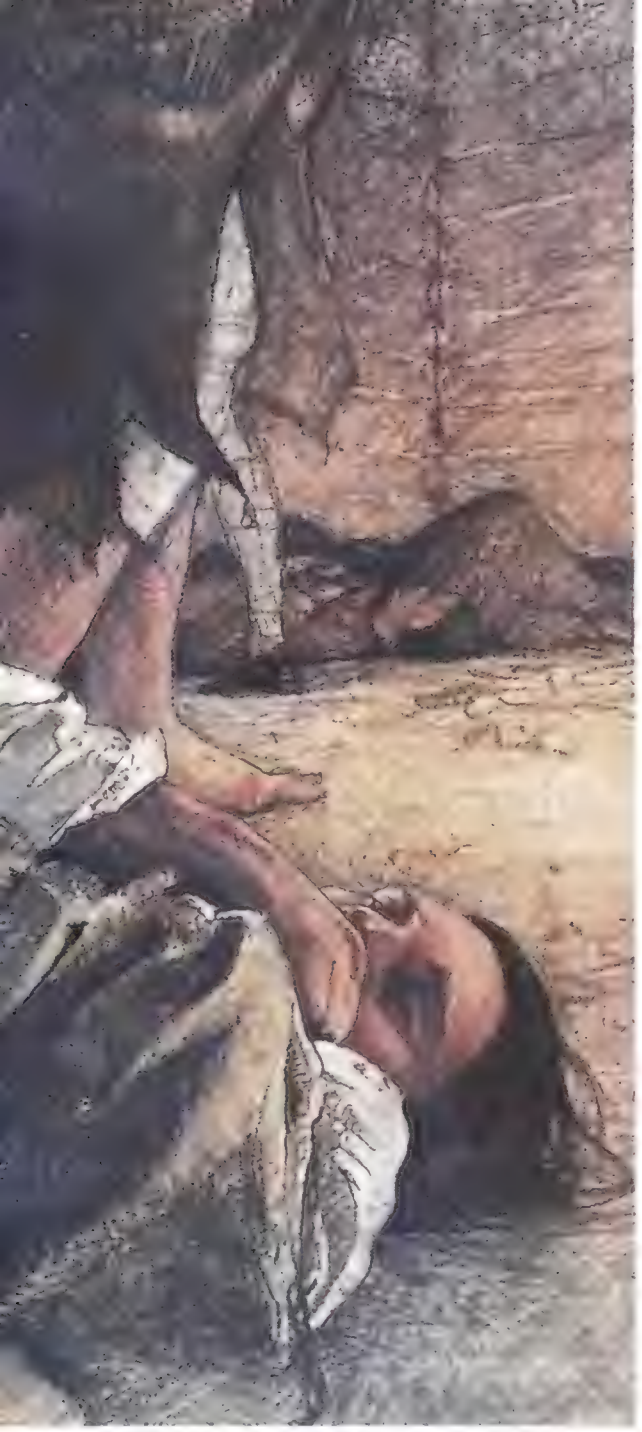
The Americans quit Canada. From 10,000 strong, they are reduced to 5,000, many of them sick. They retreat down Lake Champlain. Col. John Trumbull, son of Connecticut's governor, watches the shattered American army straggle into Crown Point, a few miles north of Ticonderoga. He writes: "At this place I found not an army but a mob, the shattered remains of twelve or fifteen very fine battalions, ruined by sickness, fatigue, and desertion, and void of every idea of discipline or subordination." Conditions are as bad at Ticonderoga, which Col. Anthony Wayne calls "the last part of the world that God made & I have some ground to believe it was finished in the dark."

In Canada, a British army masses. Gen. Guy Carleton is also building a formidable fleet. He plans to push down Lake Champlain to Albany before winter, cutting off New England from the rest of the Colonies.

Atop Rattlesnake Hill, 200 feet above the lake, American soldiers are axing down forests. They use the lumber to build cannon installations, huts, barracks. Troops march in from across the Northeast until the new fort's garrison will reach more than 10,000. Ticonderoga, across the lake, will have about 2,000 defenders.

JULY 28, 1776

In honor of the recently signed Declaration of Independence, the new fort, encompassing 300 acres, is christened Mount Independence, with a 13-gun salute. A letter in the *Boston Gazette* describes the ceremony: "Immediately after divine worship the Declaration of Independence was read by Colonel St. Clair, and having said 'God save the free independent States of America!' the army manifested their joy with three cheers. It was remarkably pleasing to see the spirits of the soldiers so raised after all their calamities; the language of every man's countenance was, 'Now we are a people! We have name among the states of the world!'"



Military engineer Jeduthan Baldwin, helped by the Polish volunteer Thaddeus Kosciuszko, directs construction at Mount Independence, erecting several hundred buildings. In his journal, he notes that he also supervises a range of workers: "I have the intire direction of all the House & Ship Carpenters, the Smiths, Armourers, Roap makers, the Wheel & Carriage makers, Miners Turners, Coalyers, Sawyers & Shingle makers, which are all togeather 286, besides the direction of all the fateagueing parties."

As fortification of Mount Independence proceeds, Gen. Horatio Gates, major general of the northern forces, names Brig. Gen. Benedict Arnold supreme commander of the American fleet on Lake Champlain. Unfortunately, there are no boats. But Arnold, knowing the British cannot take the fort without control of Champlain, focuses his fiery energies on building America's first war fleet. Word of this tiny but growing force reaches the British. All summer long they are busy outbuilding Arnold. But they are also, fatefully, delaying their attack week after week until they are sure they can crush him.

SEPTEMBER 18, 1776

Arnold writes to General Gates, pleading for "one hundred good seamen as soon as possible; we have a wretched motley crew in the fleet. The marines, the refuse of every regiment, and the sailors, few of them ever wet with salt water—we are upwards of one hundred men short."

Arnold has assembled two schooners, a sloop, four maneuverable rowgalleys with lateen sails, and nine gondolas. But the British general, Carleton, working with more professional carpenters at St. Johns, amasses a mini-armada. Just one of Carleton's vessels, the *Inflexible*, is so heavily gunned that it could take on Arnold's entire force.

Arnold hides his fleet in the lee of Valcour Island, close to the New York shore over near Lake Champlain's northern end. To attack him, the British ships must round the island below him and beat back upward in a narrow channel—almost impossible for square-rigged vessels. Arnold hopes to take them on as they approach, one by one, if he can.

OCTOBER 11, 1776

The firing begins. As one British officer records, "a tremendous cannonade was opened on both sides." Arnold puts two of the British boats out of commission. But then, vastly outgunned, his little fleet disintegrates. "The *Congress* and *Washington* suffered greatly," Arnold reports. "The latter lost her First Lieutenant killed, Captain and Master wounded. The *New York* lost all her officers except the captain. The *Philadelphia* was hulled in so many places, that she sunk about one hour after the engagement was over. . . ."

Under cover of fog and dark, Arnold manages to sneak the remains of his fleet away south, slowing the British further. A second battle nearly finishes off his fleet. Now Carleton means to recapture Fort Ticonderoga, still hoping to snuff out the Colonial uprising. But while Arnold has delayed him at the lake's northern end, the forts in the south have been preparing. Cold weather is about to set in; a winter campaign is impossible.

OCTOBER 19, 1776

Carleton's impressive fleet reaches the Lake Champlain narrows. But the British general, scanning the shores with his spyglass, sees more than he expected. Ticonderoga and Mount Independence are crawling with more than 12,000 troops. Both forts bristle with artillery. Flags wave briskly.

Carleton is a judicious man. Lookouts on the Mount see the British fleet turn. The boats tack northward, back to Canada for the winter. Champlain is still an American lake.

Arnold's delaying action and the fortification of Mount Independence have given the Americans one year to build up their strength. With the fighting season over, General Gates sends most of the 12,000 soldiers at the Mount and Fort Ticonderoga home. A garrison remains for the winter: about 2,000 soldiers at Mount Independence and 500 at Ticonderoga. They are to work on the forts, preparing for another British attack in the spring. A large contingent are veterans of the Canadian invasion, many of them wounded or sick. Winter is coming; the winds already feel glacial. But Congress, in Philadelphia, turns its attention elsewhere. Supplies on Mount Indepen-

dence—food, medicine, clothes, blankets—grow scarce.

DECEMBER 4, 1776

Maj. Joseph Wood writes to the Pennsylvania Council of Safety: "Of all this Army at this Place, which did consist of twelve or thirteen thousand Men, Sick and Well, no more than nine hundred Pair of Shoes have been sent. One-third at least of the poor Wretches is now barefoot, and in this Condition obliged to do Duty. . . . The poor Creatures is now (what's left alive) laying on the cold Ground, in poor thin Tents, and some none at all, and many down with Pleurisy. . . . If you was here, your Heart would melt." In fact, the dying began earlier. On July 19, 1776, a torrential nightlong rain flooded the tents. Dr. Lewis Beebe noted: "Many of the sick Lay their whole lengths in the water, with one blankett only to Cover them. One man having the small pox bad, & unable to help himself, and being in a tent alone, which was on ground descending; the Current of water, came thro his tent in such plenty, that it covered his head, by which means he drowned. . . ."

By October 1, Beebe had recorded: "In the afternoon it made my heart ach, to visit the Hospital, to see the Dysentary rage, with unabated fury among many of them; when I had not one article, calculated for their assistance; one with this disorder, and two with the Scurvey, were on the brink of the grave."

November 14: "Near evening about 150 of our invaledes left camp for New Hampshire: I pity the poor feeble Shadows, fear many of them, will never reach home."

Anthony Wayne wrote to Gen. Horatio Gates on December 1 about the horrible conditions: "We shall be hard set to get the Sick away; our Hospital, or rather House of Carnage, beggars all Description. . . . The Cause is obvious; no Medicine or Regimen on the Ground suitable for the Sick; no Beds or Straw to lie on; no covering to keep them warm, other than their own wretched Cloathing. We can't send them to Fort George, as usual, the Hospital being removed from thence to Albany, and the Weather is so intensely cold, that before they would reach there they would perish."

Besides sick and dying soldiers, "Mad" Anthony Wayne, the forts' commander, had to contend with regional antagonisms made manifest in innumerable ways. In February 1777, soldiers from the Third New Jersey Regiment had dug graves for two of their dead comrades. Then they had to fight off soldiers from Pennsylvania, who intended to place their own dead in the newly dug graves. Meanwhile, the highest officers jockeyed for position, with Philip Schuyler winning out over Horatio Gates as northern commander. Gen. Arthur St. Clair was put in charge of the Lake Champlain forts.

In London, too, infighting was under way. General Carleton's lamp had dimmed, partly because of his failed 1776 down-the-lake invasion. Sir John Burgoyne, a member of Parliament serving under Carleton in Canada, returned to London and busily inserted knives in his superior's absent back. Leadership of Britain's forces in Canada went to "Gentleman Johnny" Burgoyne, a cavalry officer more inclined to prance on a steed than to slog through forests and swamps. Burgoyne scorned American frontier fighters. And military glory was only one of his ambitions. He also aspired to fame as a wit and a playwright.

Now the winter is ending. Burgoyne is in Montreal, preparing to execute his master plan: with a powerful army, he will speed down Lake Champlain, brushing aside resistance from the Americans. Meanwhile, a secondary force will march down the

In July 1777, the British placed their cannon atop Sugar Hill to train guns on the Mount, across Lake Champlain.

Mohawk River, the two armies uniting at Albany. Then—his plan is vague on this point—either Gen. William Howe will come up the Hudson Valley, cutting off New England from the rest of the Colonies, or Burgoyne will march down the Hudson himself while Howe takes on George Washington in the south.

JUNE 1777

As the summer fighting season approaches, Burgoyne prepares his army, consisting of both British regulars and Hessians. Burgoyne also has Indians under his command, if not actually under his control.

As Burgoyne's troops mass, the Americans miscalculate. For one thing, George Washington is sure Burgoyne will sail down the Atlantic coast, to reinforce General Howe in New York. And so Congress declines to build up the troops at Ticonderoga and Mount Independence, and sends only scanty supplies. Gen. Arthur St. Clair inspects the garrisons and despairs: "Had every man I had, been disposed of in single file on the different works, and along the lines of defense, they would have been scarcely within the reach of each other's voices; but Congress had been persuaded that the enemy would make no attempt in that quarter, and such a number of men only as were judged to be sufficient for constructing the works that had been projected were assigned to me."

St. Clair confers with General Schuyler. They agree the forts have too few troops. If Ticonderoga falls, they decide, St. Clair will consolidate his men at Mount Independence. If they cannot hold the Mount, they will retreat to the south.

Over the winter, the ailing soldiers had managed to build 21 rock-filled cribs, spaced across the quarter-mile of frozen lake separating the two forts. When the ice melted, the cribs sank, becoming anchors for a 12-foot-wide floating bridge. North of the bridge, to stop the British fleet, the men floated a boom of heavy timbers. For good measure they slung a thick chain from shore to shore.

As the summer comes on, the soldiers who survived the winter build new breastworks and finish the star-shaped fort on Mount Independence. They also complete a series of small forts and blockhouses along the lake, and southward as far as Lake George. But troops to man these defenses are few. Then an Irish prisoner of war reveals Burgoyne is on his way, leading 7,500 British and German troops, one of the most formidable forces Britain ever massed in North America.

The British fleet appears at the northern end of Lake Champlain. One Englishman records that not a breeze riffled the blue waters "when the whole army appeared at one view in such perfect regularity as to form the most complete and splendid regatta ever beheld. In the front the Indians went in their birch canoes containing twenty or thirty each; then the advance corps in a regular line with the gunboats; then followed the *Royal George*, and the *Inflexible*, towing large booms which are to be thrown across two points of land, with the other brigs and sloops following. . . ." Then came the first brigade. Sailing gaily behind, in pinnaces, come General Burgoyne and his two seconds-in-command, General von Reidesel and General Phillips.

It is a display in Technicolor, "the Indians in war paint," as historian Ralph Nading Hill describes the scene, "the German and English regulars in white, the British infantry and artillery in scarlet and blue respectively, the German chasseurs in green

coats with red facings and cuffs, the Brunswick dragoons in buff."

But "Gentleman Johnny" has burdened his troops—who cannot make the entire trip in boats—with a 138-piece train of cumbersome artillery. Also destined to slow the army, as it hacks through the wilderness, is an endless line of creaking two-wheeled carts, made of green wood. More than 30 of these ponderous wagons are dedicated solely to hauling Burgoyne's clothes and supply of champagne.

soldier, sweating in leather breeches and gauntlets, carries a 3.5-pound broadsword, a heavy musket and a cumbersome backpack.

But the American generals have made a stupid mistake. Just south of Ticonderoga stands 750-foot Sugar Hill. It towers above Ticonderoga and Mount Independence, a quarter-mile across the water. Officers from Benedict Arnold to Thaddeus Kosciuszko have for eight years urged fortifying this hill. Once, to drive home the

Under cover of night, on July 5, 1777, the American troops—finally forced to retreat—fled through the dense woods, southeast into Vermont toward Hubbardton.

JUNE 25, 1777

Burgoyne's flotilla is nearing the two forts. Rather than risk their artillery, he decides to flank them. He sends his British troops marching through the woods on the New York shore, toward Ticonderoga. Meanwhile, his Hessians tramp along the Vermont shore, aiming for the Mount. On the New York side, the going is easy enough. But the Germans, in Vermont, must hack through dense forests and brush. And General von Reidesel has his dismounted dragoons wearing thigh-high boots, each pair weighing 12 pounds. Their big spurs snag. Each

point to Gen. Horatio Gates, an officer had fired a double charge from a cannon on Mount Independence—it hit Sugar Hill only halfway up, making it obvious that artillery on top of the hill could blast Ticonderoga and Mount Independence without reprisal. Benedict Arnold once climbed the hill, and came down assuring his superiors that cannon could be hauled to its top. One officer, John Trumbull, drew up plans for placing artillery there. But generals Gates and Schuyler, and Congress as well, insisted cannon could not be hauled up Sugar Hill.

As the British advance, the American commander, St. Clair, withdraws his troops on the New York side to Ticonderoga, ceding to the British everything except the fort itself. Astute British officers quickly climb Sugar Hill. From the top, they can see all activities in the two forts below. And they report to Burgoyne: "Where a goat can go a man can go and where a man can go he can drag a gun." Burgoyne renames the hill Mount Defiance. Using oxen, the British begin hauling up cannon.

JULY 4, 1777

General St. Clair sees the cannon atop Mount Defiance. The game is over. If he keeps his men in place, cannonballs will rain on them. He decides to abandon the two forts. He will march his men to the south.

JULY 5, 1777

Just after sunset, the Ticonderoga garrison hurries across the floating bridge to Mount Independence. Men, horses, carts, crowd together on the planks. The last men over set the bridge afire. On the Vermont side, they post a gun crew to keep back the British.

Now it is dark. On Mount Independence, St. Clair surreptitiously hurries his troops southward. It is not until 3 in the morning that the British learn, from two deserters, that the Americans are gone.

Repairing the burned bridge's planks, the British hurry across to Mount Independence. The cannoneers the Americans left fail to stop them. As one British soldier notes, ". . . instead of obeying their orders, we found them dead drunk by a cask of Madeira."

Mount Independence is empty. The British plan to hasten after the retreating Americans and destroy them before they can regroup. But soldiers begin to plunder. It is 5 A.M. before a detachment marches after St. Clair.

JULY 7, 1777

At Hubbardton the pursuing redcoats catch up with St. Clair's rear guard, mostly Green Mountain Boys led by Seth Warner. For an hour Warner holds off the British. But then German reinforcements arrive. Frustrated, Warner throws himself down on a log, cursing. When he regains his composure, he tells his men to scatter through the woods and regroup farther south. Meanwhile, the British and Germans have won the skirmish. But they have been hurt. They withdraw back to Ticonderoga and Mount Independence.

In London, hearing that the Champlain Valley is taken, King George III rushes into the queen's quarters, shouting, "I have beat them! I have beat the Americans!" France is already cooling toward the Colonists. Champlain Valley settlers are panicking. Seth Warner writes to officials in New Hampshire: "Many of the inhabitants have fled and left all in the hands of the enemy, and many more have taken protections of the British."

George Washington shrugs off the gloom. He agrees with Nathanael Greene, who says, "General Burgoyne's triumphs and little advantages may serve to bait his vanity and lead him on to his final overthrow."

Burgoyne, in fact, is feeling bubbly. He commandeers a lakeside mansion on the New York shore and settles in with his mistress, the wife of one of his officers.

He garrisons Mount Independence with Hessians. He marches the rest of his army south through New York, hacking through 26 miles of spruce jungle and swamp. The Americans fell trees across the British route, rolling boulders to dam streams and flood what little trail there is, burning crops, collapsing bridges. It takes Burgoyne's troops 24 days to travel the 26 miles to Fort Edward, on the Hudson River. They arrive exhausted

Meanwhile, rival bands of Burgoyne's Indian allies settle an argument by killing and scalping Jane McCrea, the beautiful young fiancée of a British officer, whom they were supposed to be escorting to safety. Burgoyne is outraged. But if he executes the murderer, the general is told, the Indians will desert. When Burgoyne pardons the killer, settlers are enraged, and they rally to the American cause.

Burgoyne is oblivious. Each morning the German officers are awakened by tubas, the British by fifes and drums. The general and his staff spend their days at picnics and dinner parties and cards. The Americans consolidate their forces.

Burgoyne sends 800 Hessians to Bennington, Vermont, to get horses. He is sure the locals will be friendly. The force's German band plays and its horseless dragoons stumble in their 12-pound boots, snagging their sabers in bushes. But instead of a welcome they find New Hampshire's John Stark and Vermont's Seth Warner with 500 militiamen. The Americans shred the Hessians. When Burgoyne sends reinforcements into Vermont, they are routed, too. Burgoyne notes: "The Hampshire Grants, a country unpeopled and almost unknown in the last war, now abounds in the most active and rebellious race on the continent and hangs like a gathering storm on my left."

On the American side, morale immediately lifts. Burgoyne's Indian allies, no fools, desert. Meanwhile, John Stark's militia severs Burgoyne's communications to Fort Ticonderoga and Mount Independence, and Canada.

Realizing the Americans had fled, the redcoats, crossing Champlain by floating bridge, approached the Mount. The British overran the fortifications in pursuit of the rebels.

To the west, the British army advancing down the Mohawk Valley to meet Burgoyne at Albany hears rumors—spread by Benedict Arnold—that Arnold is advancing with an enormous force. Actually, Arnold's force is quite a small one. But the disinformation frightens the British, who flee back to Montreal. Burgoyne complains, "Wherever the King's forces point, militia to the amount of three or four thousand assemble in twenty-four hours."

Ultimately, the two armies engage in New York, at Saratoga. On October 17, 1777, Burgoyne surrenders.

Having taken Lake Champlain, General Burgoyne celebrated victory with his mistress. Within months, he would surrender at Saratoga.

NOVEMBER 8, 1777

Learning of Burgoyne's defeat, the British troops at Ticonderoga and Mount Independence begin their retreat to Canada. "I have the pleasure to inform you, that the Enemy have abandoned Tyconderoga Mount Independence Vt. on Saturday Last After demolishing all the Fortifications, Bridges, Burning all the Houses, and distroying all Stores Cannon etc. which they could not bring off," Samuel Herrick writes to the Council of Vermont.

Now it is 221 years later, and David Starbuck has come back to Mount Independence. Ticonderoga has long been reconstructed. But the Mount, its buildings burned to the ground, reverted to forest and cow pasture, and remained virtually untouched until Starbuck began his digs.

Starbuck walks the trails, delighted the site is pristine. Those who stop at the park's wood-frame visitors' center will find artifacts unearthed by Starbuck's diggers and underwater archaeologists from the Lake Champlain Maritime Museum. But on the Mount, tourists will find pinewoods, cedar groves, pastures, and stunning views of Lake Champlain.

"This was one of the huts; it's where some soldiers lived," Starbuck says. He is looking at a line of stones in the ground, the old foundation. "And this is the other wing of the hospital." Another line of stones.

It is hard, Starbuck admits, for visitors to gaze at those mute stones and visualize 10,000 soldiers working on this mountaintop, or 2,000 sick men holding on through a subzero winter. "It makes interpretation harder," he insists, "but Mount Independence is the best big Revolutionary site we have."

In 1776, Starbuck says, as he wanders the mountaintop, Americans were not yet a country. "New York hated New Jersey, and New Englanders hated everybody," he says. "This was one of the first places they came together to function as one people against the mother country. They had poor provisions. It was a terrible winter. They bought one year for the American army, and it succeeded at Saratoga. Otherwise, I think, in 1776 the British could have split off New England and won the war."

Today, archaeologists continue to recover this past. In 1935, divers raised Benedict Arnold's warship *Philadelphia*, sunk at the battle of Valcour Island. The vessel now rests at the Smithsonian's National Museum of American History. In 1997, archaeologists mapping the lake bottom with sonar discovered another of Arnold's lost gunboats, resting upright, its mainmast and topmast still intact.

Starbuck and his diggers, too, have found remnants of the long-gone army. They know the men in the hospital suffered, not only from smallpox but also from measles, typhus, dysentery and "the itch," which came from infrequent washing and sleeping on bare ground, their skin covered with sores. Doctors had little to prescribe except wine and rum.

"It's shallow soil on this mountain, too shallow in many places for them to have buried the dead," Starbuck says. "As many as a thousand of them died, but where most of their bodies ended up is a mystery for the future."

He stands at the cliff where the huge crane once hoisted up supplies from boats. Below, on flat land beside Catfish Bay, the soldiers planted gardens. "I'd guess that we still haven't located a couple of hundred buildings," Starbuck says.

This hilltop is a little haunted. Starbuck cites Matthew Kennedy, a soldier on Mount Independence, who wrote to his brother in Goffstown, New Hampshire:

"Loving brother, I inform you that I am and have been in a low state of health for some time past and don't imagine I shall get well very soon. Wherefore I earnestly intreat you not to delay coming for me or if you can't come yourself. Send a man that you can confide in and a horse for me; let whoever comes; bring some butter and Indian meal with him to serve me on the way home. I can get discharged as soon as one comes for me; but am as frail at present that I could not venture home alone."

Matthew Kennedy's family did travel to the Mount to take him home. But they were too late.

Richard Wolkomir and his wife, Joyce, wrote recently about nurses in a Vermont hospital. Illustrator Greg Harlin works from his studio in Annapolis, Maryland.

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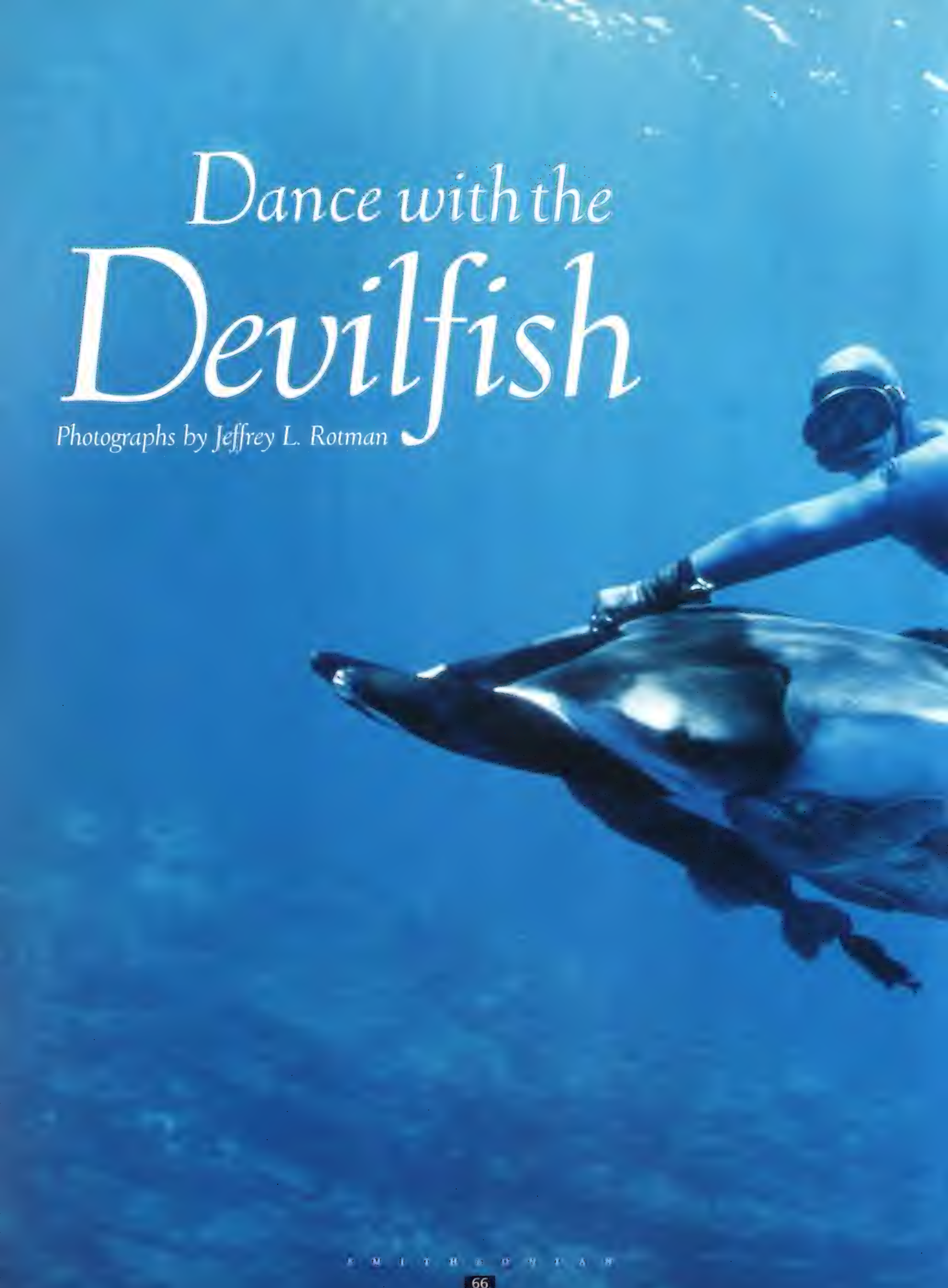
Dance with the Devilfish

Photographs by Jeffrey L. Rotman



IN BLUE WATER SOUTH OF BAJA California, close encounters of the graceful kind are the norm between divers and manta rays. It is these great fish—they can grow to 21 feet across and weigh a ton—that approach the divers, rather than the other way around. They eat only plankton and very small fish and are anything but the devilfish of fiction. They have realized the divers pose no threat. The mantas will spend an entire day "flying" up to divers, as though they enjoy the visitors' dropping in.

The divers are part of an informal network of men and women—oral surgeons, abalone fishermen, real estate agents and construction workers—who meet several times a year in different parts of the world to dive. Members of this extraordinary group are free divers: no air tanks, no air hoses. Many can go down 100 feet or, on a dive of less exertion, stay under three minutes. They come to these Mexican islands to catch 100- to 200-pound yellowfin tuna, but they always take a day or two to commune with as many as five mantas at once. The result is a ballet like none other. *John P. Wiley, Jr.*

A symbiotic remora fish rides the underside of a manta while a diver hangs on from the top. (These pictures were taken before Mexico prohibited touching the fish.) In the inset at right, remoras ride front and back, while in the inset below, the sucker disk that attaches remora to manta can be seen. The remoras eat the manta's scraps, earning their keep by removing parasites.

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PEACE OF MIND

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Little *Engines* That Still *Can!*

Across America, short-line freight trains are pulling their weight

In rural Virginia, Buckingham Branch engines push freight cars across a bridge over the James River.

BY KEVIN KRAJICK

PHOTOGRAPHS BY CAMERON DAVIDSON

ROBERT AND ANNIE BRYANT ARE NOT EXACTLY TYCOONS. They live in poor, deeply rural Buckingham County, Virginia, where they grew up and married, 43 years ago. Like many of their neighbors, they raise a few beef cattle for extra income and know just about everybody. But a few years back the Bryants acquired the sort of property most people never dream of: their own railroad. Not a quaint steam operation for transporting summer tourists, but a real freight line.

True, the newest of the Buckingham Branch's three diesels dates from 1951, and most of the "stations" on the 17.3-mile track are theoretical spots in second-growth forest where depots stood a generation ago. The BB has only eight shippers and nowhere to turn around at either end, so the engines pull loaded cars forward in the morning, then push empties back at night; a conductor in the caboose leading the return watches for deer and pickup trucks.

No matter. The railroad is still in business, doing what railroads have always done best: moving large quantities of very heavy cargo, such as stone, lumber and ore. The sprawling CSX railroad picks up BB cars at a junction and sends the freight on its main lines bound for Kentucky, Florida, Mexico, Europe and Asia.

The Bryants are among hundreds of people in recent years to buy dinky, declining old feeders, or "short lines," mostly from big railroads ready to abandon them—and the rural economies they serve—as money losers. Nearly one-third of the nation's one-time 250,000 miles of railroad line has been torn up in the past 80 years; and about 2,000 more miles are abandoned each year. Short lines have helped save our disappearing tracks: less than 20 years ago 225 short lines existed; now, some 500 operate what amounts to more than an eighth of U.S. rail lines, in pieces as short as three miles. Some lines have been bought by local governments eager to keep shippers going, others by the grain elevators, steel mills or paper plants that depend on them. A few, like the 105-year-old Aberdeen & Rockfish Railroad in North Carolina, are still owned by the families that started them. But most have passed to new entrepreneurs.

The national railroads' deconstruction into main lines pumped by local capillaries is no small matter. Despite savage competition from trucks, 40 percent of intercity freight tonnage (calculated in tons carried per mile) still moves by rail—mostly bulky commodities that go more cheaply and efficiently that way: coal, grains, chemicals, ores, wood. (A 100-ton freight car carries four times more than the biggest truck.) Then there are bicycles, frozen chickens, lightbulbs, beer. Without short lines, a lot of this stuff would not go by rail—and some of it might not go anywhere. Big railroads, burdened by high wages and rigid union rules, have emerged from long decline in part because short lines have taken on the slow tasks of building trains one or two cars at a time, fixing decayed branches, cultivating small customers.

The big guys do the more glamorous—and profitable—work of tearing cross-country at 60 miles an hour with fully loaded 150-car trains. The short-line survival formula: lower wages, used equipment and nonunion employees who do a bit of everything. John Gray, a freight car repairman on western Pennsylvania's little Everett Railroad, told me one day, "We're not getting rich. But we're moving products, and people have jobs."

Short lines have brought things full circle, for the first American railroads, starting in the 1830s, were all short lines. By the years just after the Civil War, the short lines had consolidated into a couple of hundred big railroads. But from the 1870s through the early 1900s, many more short lines were built. Each small town wanted its own rail connection. In time, big companies bought short lines, then one another. The industry boiled down to the dozen or so giants—like Conrail and CSX—that have dominated recent decades. Short lines reemerging out of them now speak again of the places they belong to: the Wiregrass Central; Caddo, Antoine & Little Missouri; Dardanelle & Russellville; Georgia Woodlands; the Bloomer Line; Crab Orchard & Egyptian; Keokuk Junction; Bangor & Aroostook; Otter Tail Valley; Oil

Positioning cars for the day's run, Buckingham Branch conductor Joe Jones rides a flatcar used to haul wood; the line's owners (left) are Annie and Robert Bryant.

Creek & Titusville; Conemaugh & Black Lick; New Hope & Ivyland; Pee Dee River; Nimishillen & Tuscarawas; Thermal Belt; Waccamaw Coast; Steelton & Highspire; Logansport & Eel River; Beech Mountain; Bad Water.

The Buckingham Railroad opened its first four miles in 1885, serving rural roofing-slate quarries worked by Welsh immigrants. The quarries boomed as a result. In the 1890s the rails were extended to Rosney, a busy timber center. Annie Bryant's father hauled "short wood"—logs destined for paper mills—from his farm by horse and wagon to these trains in the 1930s.

By the early 1900s, the U.S. rail network had reached its zenith, providing transport for just about everything, everywhere. Then the Buckingham served 16 stations on a 21-mile route, picking up local produce, molasses and tobacco, delivering coal and the U.S. mail, taking on passengers bound for nearby rural towns or distant cities served by connecting outfits. Inevitably, some of these distant railroads got bigger; the Buckingham became part of the Chesapeake & Ohio system, later merged into CSX.

Robert Bryant grew up near the line's New Canton station, where his father was a C&O conductor. He says one of his best early memories is a summer day when he and a cousin picked strawberries to pay the 25-cent fare to one-street Dillwyn, the county's main town. "We bought some suckers and penny candy down there at the store and got back on the train," he says. "We stuck our heads out the window the whole time and ended up with hair full of cinders from the steam engine."

Despite the fuzzy romanticism of childhood and family memory, the Buckingham was already in decline. In the 1920s, many county residents bought autos. Heavy timbering—probably accelerated by rail access—denuded the countryside. Quarries were worked out, or closed when cheaper asphalt shingles came in. As roads improved (in part thanks to gravel hauled by the train), trucks competed. In 1935 the end four miles of track, to Rosney, were torn up. The last passenger car ran in May 1954.

Eventually the C&O razed every station except Dillwyn's—today, the end of the line—and woods began retaking much of the land along the track. By the 1980s only a few shippers remained, and CSX was allowing the track to fall apart. Dillwyn was, and is, a place stopped in time—weathered brick buildings with 1950s signs; pastures coming right into

Top: Prior to departure from the Dillwyn station, engineer Robert Leighty winches down a strap over a load of logs. Bottom: Near the BB line's Arvonia stop, trackmen replace old ties.

town: the wood-floored Ranson Brothers appliance store with its menagerie of armchairs, oil-lamp chimneys and long-expired canned goods.

The Bryants met at 14 and were high school sweethearts, but Buckingham County could not hold them. Robert skipped his last day of school in 1953 to follow his dad into the C&O, as a telegram messenger in Richmond. He and Annie moved all over the South following Robert's promotions. By 1987 they were in Baltimore, where he was a CSX marketing manager. Annie was a high school business teacher. That year CSX decided it had too many railroads—and employees. At 53, Robert was offered early retirement. The Bryants moved back to the farm they'd kept, and considered what to do next.

The answer came from CSX computer printouts. Robert knew the Buckingham line was losing money, and the company was fixing to abandon it—close Dillwyn Station, tear up the tracks, end of story. "Robert did not like that thought at all," says Annie. "He got this crazy, far-out idea that we would run it." Robert made it sound simple: "Well, I had some experience in the business, and you think: all we need is some track and some power. Then all you got to do is keep it up and market it."

Spin-offs had begun in earnest in 1980, after the federal government deregulated the industry. This allowed big railroads to sell lines to new operators who didn't have to honor longtime union contracts. Or, they could simply sell lines for scrap metal—which many did. Many buyers had rail backgrounds, as managers or track contractors, though not all. For example, when Robert and Annie became friendly with Alan Maples, 36 years their junior, he had already bought up a short line, although he had never worked for a railroad.

"I knew I wanted to pursue railroading as a career," Maples tells me nonchalantly one day when I visit him, "and it was appealing to own one." He grew up watching trains, spent high school summers studying railroad balance sheets, and collected rail memorabilia. After stints as stage manager for a magic show and tax preparer, Maples, in 1983, bought the defunct four-mile Everett Railroad near Altoona, Pennsylvania, with the money his grandparents saved for his college education, and a lot of loans. He was 22. The Everett is still growing and he still hasn't gone to college. From him, among others, the Bryants got free, friendly advice and a live example that, yes, this could be done.

It took two years of negotiations with CSX for the Bryants to get title to the tracks and Dillwyn Station, plus an old locomotive and caboose—all for $72,000. "Oh, me! I did a lot of praying," says Annie. "Robert didn't know anything about locomotives. I didn't even know how to talk on the radio." The roadbed was in sad shape; brush and trees scraped the

Track maintenance is a demanding and never-ending task; here, a crew of trackmen, working by hand, remove an old cattle crossing and regauge a curve.

train from either side, and long stretches of hand-hewn ties laid in 1918 were badly rotted, presenting the specter of derailments.

Local help soon appeared. Jack Yowell, a CSX engineer, offered to run the locomotives, though the Bryants could pay less than half his $70,000 yearly earnings. The trade-off: Yowell could spend more time with his family instead of working long, unpredictable hours on the far-off main line. Michael Pace, a laid-off CSX track worker, was hired as chief of track maintenance. Yowell taught Pace how to be a conductor and agreed to help him fix the tracks. "Pete" Peters, a pensioned-off CSX mechanic who had worked with Robert's father, volunteered to do locomotive maintenance for free, so that he would have something to do. (But his efforts haven't gone unrecognized. At last year's Christmas party, the Bryants named their Engine No. 1 the "Pete Peters.") Annie reluctantly gave up a teaching job to run the office; on a Monday morning in 1989 the BB ran its first train.

In the early years, cars sometimes derailed, but they didn't tip over, so the crew jacked them back onto the rails with oak blocks. Usually, things were going again in a few hours. Lacking the automatons CSX uses to detect track flaws, pull and drive spikes, install ties, pour ballast and lay rail, the trainmen did it the old way: with shovels, rakes and narrow-headed sledgehammers called spike mauls. They replaced 2,000 ties a year by hand and filled in washed-out ballast by the wheelbarrow load. They gingerly lowered 5,109-pound replacement rails off a handcar. When they got enough money to buy a backhoe in 1993, it was a major event.

Robert pushed wheelbarrows and got himself qualified as an engineer so he could run the train. ("Only in an emergency!" he stresses. "Me running a train scares everyone, including me.") But mostly he has concentrated on rebuilding the business itself. Most shippers still won't use the train, for trucks move a lot faster, without fixed schedules, and go everywhere.

The train goes back and forth only on Monday, Wednesday and Friday—the other two days being reserved for fixing the tracks. The top legal speed on the still run-down track is 10 miles per hour. However, the Bryants hope soon to have this up to 25; they offer personal service and low rates (about $230 a car), and even rebuilt a decayed siding for one woodyard. They've hung on to the biggest shipper, a kyanite mine, whose product is used to make steel-kiln firebricks, spark plugs and spacecraft shielding. One company ships cinders for cinder block. A quarry sends crushed slate used in landscaping. One of the now-reforested county's woodyards ships fresh-cut railroad ties to a preservation plant in West Virginia.

Steve Shippee, who runs a pulpwood yard outside Dillwyn for the huge Westvaco Corporation, says he uses the BB because a company paper mill in Covington, Virginia, has a CSX siding. It takes three days, instead of three hours by truck—but

The BB's tiny Dillwyn station, flanked by Robert Bryant's 1953 Chevy pickup, seems a place that time forgot.

costs $3 a ton less. "Service has gotten a lot better with local owners," he says. "I can call Bob whenever I need to and he'll fire up the engine. If he wasn't here, we'd probably leave."

Despite the Bryants' down-home image and local roots, they have "done well," in Robert's words. Business is up from an initial 800 cars a year to 1,600, and the staff has increased to 11, including part-timers and the Bryants' son, Mark. Loans taken early on from a local bank are paid off. A lot of track rebuilding help has come from state grants channeled through county officials who want to keep the rails open. But Robert and Annie still haven't taken any income, living instead on Robert's pension and part-time farming, and plowing revenue back into infrastructure and higher salaries (Yowell now makes something over half his previous pay).

At this point, I must say that I am not a fanatic about trains; but one of *my* long-lost childhood memories is of growing up across the highway from a Penn Central switching yard in Kingston, New York, where the earth-shaking bang of coupling freights rattled our house every night—and gently rocked my bed, sending me to fine dreams. I have always wanted to ride one.

So I am up in the cab at Dillwyn Station at 6:45 one frosty December morning, when conductor Bernard Patterson and engineer Robert Leighty (Yowell is off to hunt deer) start the 1,500 hp Engine No. 1. The 16 giant cylinders come to a roar, and we slowly back a red caboose south across Dillwyn's main street to a weed-grown yard at the start of the tracks. Automobiles stop for us; the biggest threat at this and other low-speed short-line crossings is not trains hitting cars—but cars hitting trains (usually without bad injuries). Perhaps drivers can't conceive of a real, live locomotive showing up here. (As Alan Maples carps, "How blind do you have to be not to see a railroad train?" Among vehicles recently self-destructing against his engine were a Honda Accord and a brand-new Chevy pickup.)

We get safely across and prepare to fetch six empty gondolas and three freight cars loaded with rail ties. Bernard hops off to uncouple the caboose, then calls Robert on a hand radio to tell him to pull the train forward. Bernard muscles over a heavy iron hand switch so the new cars can be moved in from the siding. Robert backs up while Bernard radios the closing distance. "Two cars . . . one car . . . 15 feet. Eight feet. Five, four, two, one, couple!" Bang! the couplers hit and snap shut, raising clouds of rust flakes off the gondolas' sides. This is exactly what I remember hearing so long ago.

A half hour of backing, shuffling and sorting later, all the cars are coupled in the right order for later dropoffs or pickups—often a complex puzzle—and Bernard has air-brake hoses connected and the caboose put back on at the end. "OK, head north," he says, hopping into the engine cab. We rumble back past Dillwyn Station to the kyanite plant, a mile or two away. Here, Bernard climbs down and we repeat the routine for a loaded boxcar and two empties. Bang! Rattle, rattle. More maneuvers to get the cars in order. Then down to Westvaco for another extended heavy-metal ballet. No wonder big railroads don't want to do this, I think. These guys spend very little time actually going anywhere.

It is midmorning when we pick up speed—10 mph seems heady now—and start with 13 cars for the CSX junction some 13 miles distant. Paralleling the main road north out of town, we wave across fields to truckers outpacing us and take in the inverted landscape peculiar to railroad rights-of-way: the neglected backsides of everything, where teenagers hide out to share six-packs, folks dump brush cleared from the side yard, vine-covered abandoned sheds decay into dust and no one ever bothers to cut the weeds. No asphalt, convenience stores, power lines or cars; we are curiously close to nature on a freight train.

We come upon Alpha, a trackside huddle of three houses and five trailers. A back door pops open and two boys about 3 and 7 in matching blue T-shirts wave enthusiastically. We wave back, and the tracks veer from the highway.

Wood-and-iron depot signs mark the graves of disappeared stations: Slate Hill, Penlan, Johnson.

Here, the train traverses miles of forest and swampland lapping the railbed. Beaver ponds sit in low spots. Occasional farmhouses and loggers' clear-cuts are visible through the trees. Three wild turkeys flap out. The trainmen point out the spot where a bobcat has been seen on the tracks. We cross twisty little Hunt Creek 13 times on wooden bridges. Relics of the ruined past constantly whisper from the woods. Hand-cut telegraph poles with intact wooden insulator spools. Wood-and-iron depot signs marking graves of disappeared stations: Slate Hill, Penlan, Johnson, Arvonia. Rock-walled quarry pits brimming with dark-green water.

Bernard, a former CSX track worker, tells me his father, brother, grandfather and great-grandfather worked for the C&O—all right here. He points out a depot consisting only of 16 concrete stairs clinging to an overgrown hillock. "I remember my father going up those stairs when I was 5," he says; we are silent for a while. As the train rounds a steep curve before New Canton, the cars seem nearly to scrape a high rock wall covered with ferns and mosses. Bernard gestures to a hollowed-out spot. "Look, that's the hobo cave. The hoboes made campfires in there and caught trains to wherever they were going. That's what the old people say, anyway." We stare into the cave: it is empty. Even the hoboes have deserted.

On the other side of the curve, the train emerges into the present, and the end of the BB line. A high steel bridge spans the James River. On the other side is the CSX main line, in country opened to expansive, sunny cornfields. Robert gets radio permission from a CSX dispatcher in Jacksonville, Florida, to enter via an electronically controlled switch, and soon we are whizzing along on well-groomed CSX track at 25 mph. At a rail yard, we change our full cars for an odd assortment of empties, with the usual noisy toil.

Then the dispatcher tells us to wait there for two CSX trains to clear the main line. We sit and sit; finally the first roars by our ramshackle assemblage, hauling 143 identical gray-and-yellow hoppers uniformly heaped with coal; shortly after comes another with 106 of the same. No cabooses; automatic sensors are telling the locomotive crew what is happening in back, and a computerized voice over our radio announces the condition of track ahead. Only then does the dispatcher allow us to crawl home, caboose first; Bernard radioes to Robert that the crossings are clear, and pulls on a chain to blow an air horn—long, long, short, long.

It is a reminder that the BB and other short lines don't exist in their backcountry enclaves as if in a vacuum. Not only do they depend on the big brothers to whom they connect; new venture-capital outfits are recognizing they can make money on short lines, and have begun buying them. The spiraling prices they pay are pushing out prospective mom-and-pop operators like the Bryants. The biggest is the San Antonio, Texas, based RailTex, a public company that now has 29 short lines. Chief executive Bruce Flohr proudly tells me, "We have seven people working full-time in acquisitions."

The problem is, to some people a RailTex is just one big brother replacing another. Buckingham residents were happy to see the Bryants; but in 1994, when RailTex offered to buy the Central Vermont short line from Canadian National, Vermonters picketed and U.S. congressmen hauled Flohr into a hostile hearing. They feared distant RailTex would run

Engineer Robert Leighty heads a BB-line train south across the James River. His earplugs are a must, as the locomotives generate a rumbling roar.

On a return run to Dillwyn, Buckingham Branch conductor Bernard Patterson waves from the caboose; the Bryants started the BB with it and one engine.

things a whole lot more ruthlessly than people like Robert and Annie, who have to look their employees in the eye every day. RailTex bought Central Vermont anyway, and cut staff from 165 to 95, although it did retain local management.

"Big holding companies usually hurt communities more than they help," claims Greg Weber, part owner of Nebraska's Fillmore-Western short line. "To them a short line is just another number in their book." With a shortage of new spin-offs, holding companies are trying to buy out small owners, even purchasing newly privatized lines in Argentina, Chile, Brazil and Britain. The Wisconsin Central Transportation Corporation has taken over the railroad on the South Pacific island of Tasmania. OmniTRAX, an outfit owned by Denver real estate magnate Pat Broe, just acquired the single 530-mile line to polar-bear-infested Churchill, Canada.

Such high-finance calculations seem far away at 6:30 the next morning, when I meet Bernard for a day of "gauging track." With him is jovial, cigar-chomping road master Mike Pace, and Ken Mayo, an ex-marine who has just hired on. We drive to a dirt road crossing near the hobo cave, and Mike walks along the rails, bending over every few feet with a cheap tape measure. The insides should lie 56½ inches apart, he explains—standard gauge. With so many ties softened by age, the weight of the moving train spreads them. "Too wide and the train falls off," he points out.

We come to many spots measuring 57 or 57½, or worse. Here, Mike yanks spikes with a crowbar almost as tall as himself. The men attach a chain with hooks on either end to the rails and ratchet them in with a hand winch. Then they take turns slamming the spikes back in with an 8-pound spike maul. "Ask Mr. Bryant when he's gonna buy one of those machines that does this automatically," grins Mike, and lights a fresh cigar.

Toward lunch, we walk past a deep cut in a track side bank, curving off into the woods. "I know this place. You're gonna like it," says Mike, pushing aside the brush. Fifty feet in, we hit the railroad equivalent of King Tut's tomb, the undisturbed remains of track connecting the BB to an old quarry. The ultimate short line. Trees a foot and a half across grow in the roadbed. Two wooden railcars sit rotting in deep layers of leaves and humus. Mike digs with his hands and uncovers one car's rusted but workable wheels, still sitting on old narrow-gauge rails. Up the hill, piled neatly, are thousands of roofing slates that never made the last shipment. We follow on up to a crumbled stone bridge embankment facing a rushing creek. Softball-size chunks of steam-engine coal lie scattered about. A single twisted rail juts over the water. End of the line. I ponder: What if the kyanite plant closes next year? Or the truckers lower rates a bit more? Might the rest of the Buckingham Branch someday look like this? At the moment, it seems impossible.

Kevin Krajick often rides another short line, Manhattan's West Side subway. Cameron Davidson's most recent SMITHSONIAN *story was on the fight to save American elms.*

Imagine not remembering your own daughter's name. For thousands of women each year, it's becoming a reality.

Alzheimer's disease—a major health issue for women. Alzheimer's disease is a devastating disease that takes an immense toll on people's lives. An estimated 4 million Americans have this degenerative disease that affects their ability to function normally and to remember who they are and the people and places they've known for decades. As the population ages, millions more will be afflicted with Alzheimer's disease in coming years. Alzheimer's disease may be more prevalent in women for reasons we do not understand. Some studies have suggested that estrogen loss during menopause may be a contributing factor, although this has not been proved. And certainly, women constitute the majority of caregivers for those who have the disease.

The special needs of the caregiver. Women who are family caregivers are often under a lot of stress. For this reason, it's important that they take special care of their health. Effective ways for managing stress include a healthy diet, adequate sleep and exercise and outside activities. Family members and caregivers are urged to contact their local chapter of the Alzheimer's Association for additional support.

A reason for hope. Rapid progress is being made in Alzheimer research. Drugs are available that may temporarily improve symptoms of the disease. Some preliminary studies suggest that other medications, such as estrogen replacement therapy (ERT), may make it possible to delay onset of disease symptoms, while offering other health benefits to menopausal and postmenopausal women. Other studies suggest that nonsteroidal anti-inflammatory drugs and vitamin E may offer some protection to nerve cells in the brain. The advantages of these treatments are that they are available now and the side effects are known and can be managed. As with taking any medication, you should first consult with your doctor.

More research is needed to determine whether these medications will prove to be effective treatments for Alzheimer's disease. But with your support, research will continue until this disease can be prevented.

Help is available. The Alzheimer's Association is dedicated to conquering Alzheimer's disease through research and to providing education and support to people with Alzheimer's disease and their families. To obtain the free brochure *Women and Alzheimer's Disease*, call 1-800-272-3900 or your local chapter or visit our web site: www.alz.org. Help is available for this serious health issue, so please call today. Do it for someone you love, do it for yourself.

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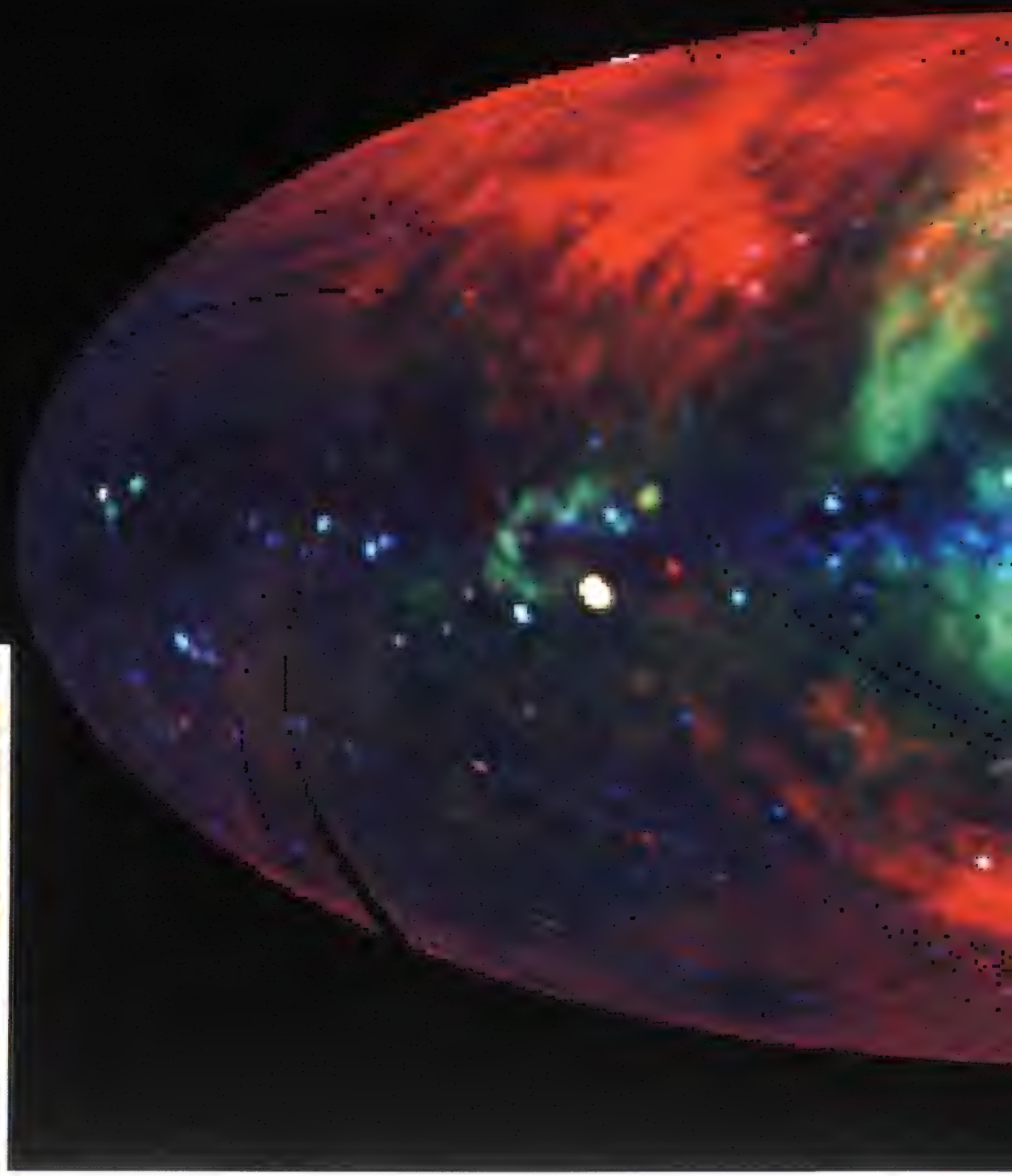
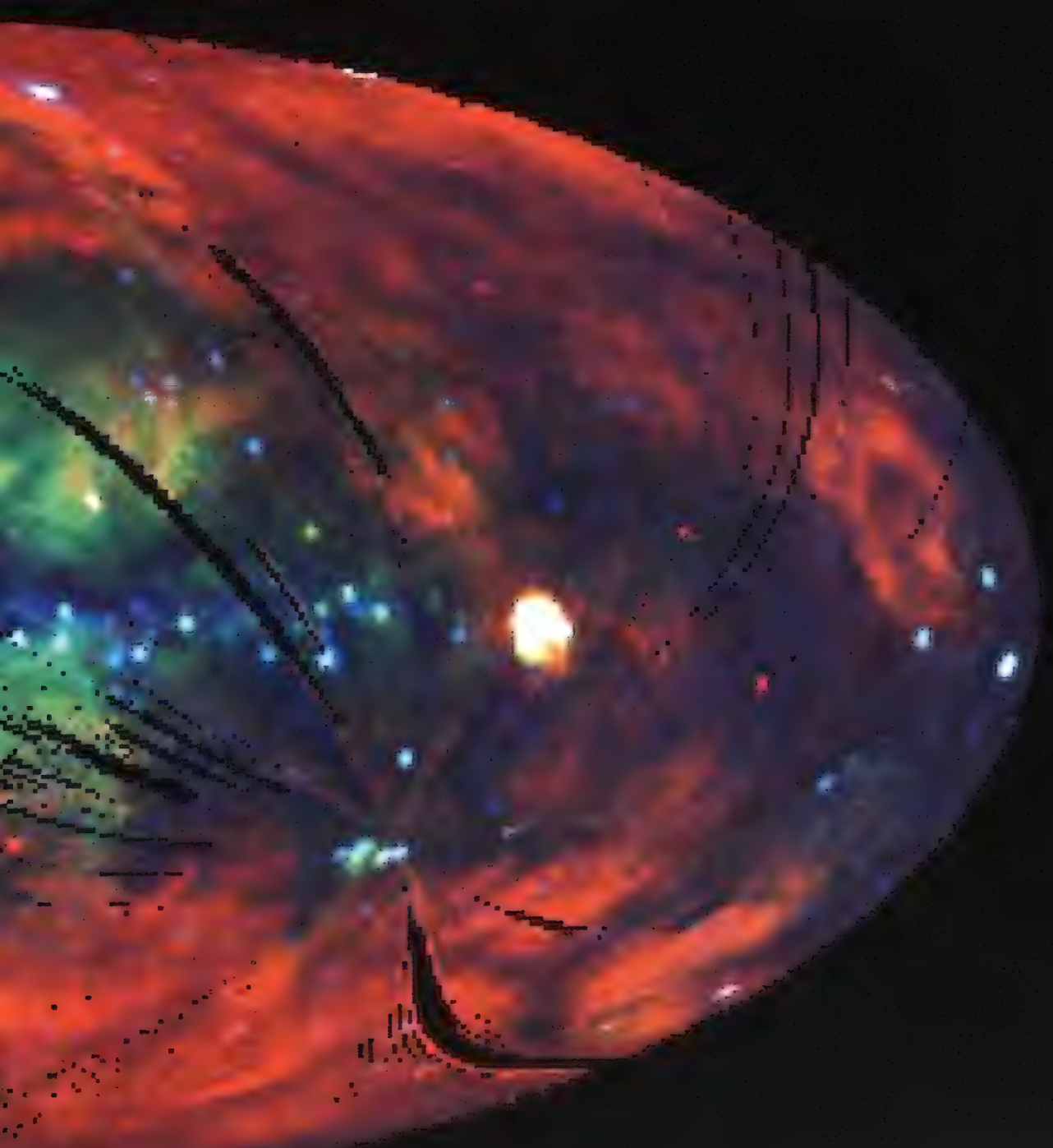


X RAYS EXPOSE A VIOLENT SKY

BY MARCIA BARTUSIAK



A composite image of the entire sky shows how it would look if we saw at X-ray rather than visual wavelengths. Inset: The X-ray telescope tube is raised so the cylindrical nested mirrors can be inserted.

SOME OF THE MOST FURIOUS GOINGS-ON IN THE UNIVERSE SHINE BRIGHTEST IN X RAYS—NOW WE'LL SEE THEM BETTER

WITHIN THE CONSTELLATION CENTAURUS IN THE SOUTHERN SKY, A CELESTIAL dance proceeds—a pas de deux from hell. There, an unimaginably dense object known as Cen X-3, a neutron star, whips around a very close yet more normal stellar companion. Forged in a powerful supernova explosion years earlier, Cen X-3 is the remnant core of a once massive star. It contains a Sun's worth of mass, but squeezed into a sphere a mere dozen miles wide. A spoonful of its pure matter would outweigh a mountain. So strong is its gravitational field that Cen X-3 draws a river of gas from its binary partner. Spiraling inward and glowing in X rays as it's heated to millions of degrees, this gas eventually crashes onto the superhard surface of the neutron star at very high speed. What results is an

additional torrent of X rays, beamed into the galaxy. The Milky Way is sprinkled with hundreds of such X-ray binaries, flashing on and off like cosmic fireflies. And some of these rays are directed toward Earth.

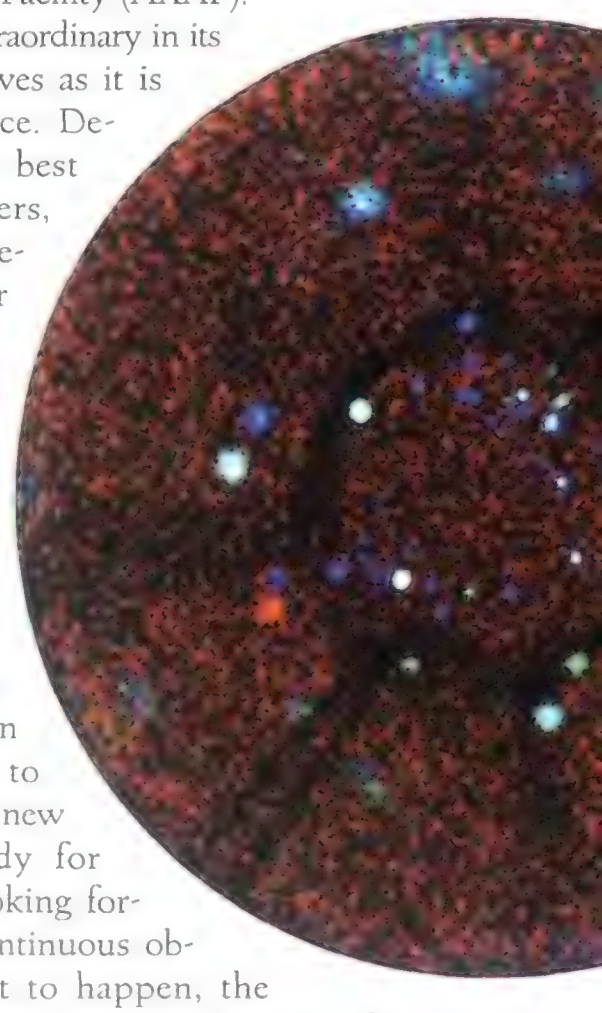
Also in the southern sky resides a blue variable star called Eta Carinae. About 150 years ago this gargantuan star, roughly 100 times heavier and four million times brighter than our Sun, erupted like a volcano, releasing two lobes of dust and gas that continue to speed outward in opposite directions at hundreds of miles per second. Slamming into the tenuous gas and dust of interstellar space, this ejecta emits an impressive flush of X rays. More recently, it was suggested that Eta Carinae may have a partner, the two stars completing an orbit once every five and a half years. X-ray emissions would then increase when the two stars are closest and their stellar winds smash together. And some of that radiation is headed in our direction.

Many of the most spectacular and most significant phenomena in our universe involve velocities and temperatures beyond our imagination. So much energy is released that they shine brightest at X-ray rather than visual wavelengths. If you want to study these hot spots, X rays are the best teachers.

It is 1996. Technician Shirley Medeiros sits in a laboratory clean room in what had been a Sears store in Cambridge, Massachusetts. She attaches a grid of gold wires to a plate of glass about a millimeter thick. This microchannel plate is actually a hexagonal array of millions of glass tubes, each about the size of a human blood cell. Any one tube can convert a single incoming photon into an avalanche of electrons, amplifying the signal strength a millionfold. Pouring onto the gold mesh, the electrons record their points of impact, so that an X-ray image can be assembled, dot by dot. The microchannel plates and the gold mesh grid together constitute the detector, or High Resolution Camera (HRC).

A microchannel plate, which amplifies signals, is lowered onto a grid of gold wire, which records their position.

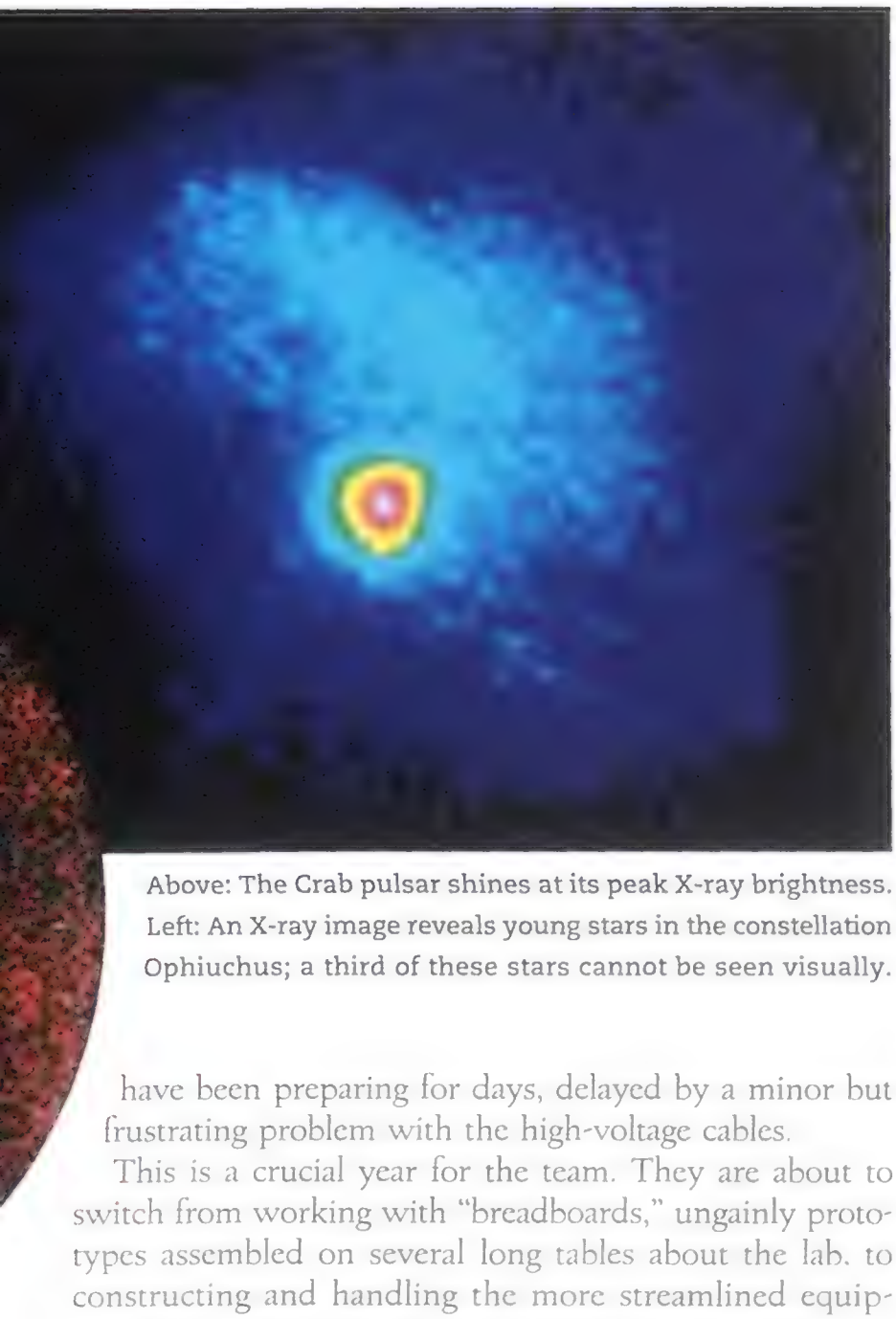
Eventually, X-ray photons from the violent X-ray binary, Cen X-3, and from Eta Carinae, will streak into Earth's neighborhood and into a set of concentric cylindrical mirrors that form the X-ray telescope. The mirrors will focus the X rays onto the detector. The whole apparatus will fly through space aboard a satellite known as the Advanced X-Ray Astrophysics Facility (AXAF).



The HRC is as extraordinary in its impact on human lives as it is as a scientific device. Decades of work, the best part of entire careers, have produced a detector exactly four inches by four inches. It was created in part by astronomers who began the field, who once could only observe the X-ray sky for minutes at a time with devices borne on rockets that soon plummeted back to Earth. Now, with a new X-ray satellite ready for launch, they are looking forward to years of continuous observations. For that to happen, the HRC has to work. And for that to happen, the scientists have to test and retest, and then test again.

The testing laboratory, right outside the clean room, resembles a miniature warehouse, it is so crammed with instrumentation. Amid a forest of liquefied-gas tanks, computer monitors and steel racks of electronic modules, instruments flash their measurements in glowing reds and greens. Here, a few dozen engineers, scientists and technicians, all with the Smithsonian Astrophysical Observatory (SAO), are assembling the camera.

Talk is minimal on a September day as team members gather in the windowless room to watch "first light." A generator in a corner of the lab is about to fire a beam of X-ray photons down a long, evacuated pipe, mimicking the arrival at the camera of X rays from some distant celestial source. The target, mounted within a bulbous vacuum chamber that resembles a tiny submarine, is the camera's key component, its X-ray detector. After years of work, the researchers are finally testing whether it will be able to "see" the rays. Physicists Almus Kenter and Gary Meehan



Above: The Crab pulsar shines at its peak X-ray brightness. Left: An X-ray image reveals young stars in the constellation Ophiuchus; a third of these stars cannot be seen visually.

have been preparing for days, delayed by a minor but frustrating problem with the high-voltage cables.

This is a crucial year for the team. They are about to switch from working with "breadboards," ungainly prototypes assembled on several long tables about the lab. to constructing and handling the more streamlined equipment set to travel into space. From now on, each test runs the risk of damaging a flight-ready instrument. In fact, every nut, bolt and resistor is painstakingly catalogued, so any broken or faulty piece can be replaced with one manufactured in the same batch.

"Are we all set?" asks Kenter.

"Let's do it," responds Stephen Murray, principal investigator of the camera team.

To the pulsing, background tones of vacuum pumps and generators, each participant wordlessly performs an intricate dance around the setup, tweaking knobs or adjusting voltage levels. The detector is exposed to the X rays for five minutes. On a computer monitor, digital dots start filling the screen, each blip representing an X-ray photon impinging on the detector, like raindrops splashing on a windowpane. The picture building up is blandly uniform.

"There are no hot spots," says Kenter with relief.

"We can't work with the plate if its response varies too much across its surface," explains Murray

The test continues without a hitch . . . which can be dangerous. "When you have no problems, you lose an edge, and that's when you tend to screw up," notes Murray.

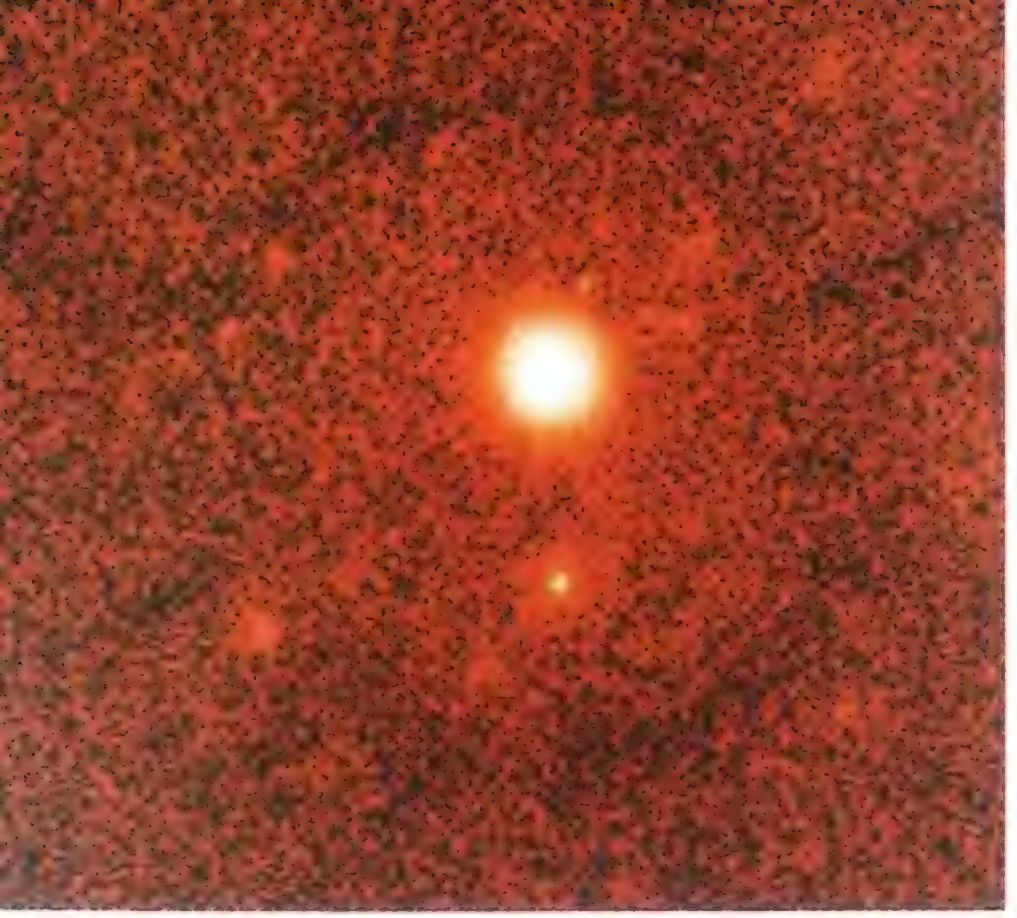
This is a side of space science the public seldom sees. "When people hear I'm working on an astrophysics project, they ask me what interesting celestial objects I'm seeing at the moment," recounts Kenter. "Then I have to tell them I'm worried about measuring the size of a hole: the celestial X rays hit the detector, which triggers a signal. But how do you interpret that signal? You need to know its strength, which means you need to know very precisely the size of the hole through which the X rays entered. The story of the X-ray telescope is a series of these many, mundane concerns."

Scheduled to be launched by space shuttle and then inserted into a higher orbit by a booster rocket this December, the $1.5 billion satellite will loop around Earth once every 64 hours and 18 minutes, going out as far as 86,000 miles (about a third of the way to the Moon) and then returning as close as 6,000 miles. From that superb vantage point, largely removed from Earth's disruptive radiation belts, the telescope will peruse the X-ray sky for at least five years. By then it will have a new name.

Whatever its future moniker, it promises to be the most powerful X-ray space instrument to date, offering a vision equivalent to the best ground-based optical telescopes. That's eyesight ten times keener than previous X-ray telescopes sent into space could manage. And its improved detectors will spy X-ray sources up to 100 times fainter.

THOSE CELESTIAL X RAYS WILL BE NO DIFFERENT FROM the rays directed into your mouth during a dental exam. In some cases, they are even generated by a similar process. In an X-ray machine, high voltages accelerate electrons to a soaring velocity. When abruptly stopped by a piece of metal, the electrons must give up that kinetic energy as electromagnetic radiation—in this case, as X rays. Charged particles plummeting onto a neutron star also emit X rays when suddenly halted, but here the intensities are literally astronomical. Comparing an X-ray binary to an X-ray machine is like comparing a hydrogen bomb to a match.

Once in space, AXAF will observe the most bizarre phenomena the Universe has to offer. Take the X-ray burster GRO J1744-28, for example. First discovered in 1995 near the galactic center, this spinning neutron star, also part of a binary system like Cen X-3, occasionally (yet unpredictably) emits an intense X-ray burp. This happened in 1996, and it was the brightest object in the X-ray sky. Sometimes it burst once an hour, sometimes not at all. Astronomers are not yet sure why an X-ray-emitting neutron star should suddenly burst more intensely. One guess is that the gas being siphoned off its binary companion is getting spread over the entire surface of the city-size orb. Eventually squeezed by the pressing force of gravity, the



The bright light at the center is a binary star in the constellation Lacerta. The small red dots are X-ray photons of lower energy than those from the binary system.

layer suddenly ignites in a gigantic thermonuclear flash.

AXAF cameras will also be spying on whirlpools of agitated matter swirling around and eventually falling into black holes, massive stars crushed so densely at the end of their lives that they've tucked themselves away in an infinite gravitational warp, allowing no bit of light to escape. The telescope will sift through the filamentary shreds of ancient supernovas to conduct celestial autopsies. The X rays given off by the remnants' incandescent atoms reveal what chemical elements were brewed inside the former star. Quasars, the extraordinarily bright objects found at the centers of many galaxies, will be targets as well. So plentiful are quasars that they fill all of space with a diffuse X-ray glow. "It's difficult to imagine that we will ever visit a quasar or obtain any benefit from one," concedes Leon Van Speybroeck, who worked on the first design for AXAF in 1970. "But we humans find pleasure in understanding the Universe."

X-RAY ASTRONOMERS ARE NOTHING IF NOT A PATIENT lot. Optical astronomers nightly trek up mountains to gather the streams of starlight that fall upon Earth. Radio astronomers can work days as well as nights. X-ray astronomers are not so fortunate. The high-energy radiation they yearn to collect is absorbed about 100 miles up by Earth's blanket of air. It takes years to develop the spaceborne instrumentation necessary to "see" it. So X-ray astronomy is sporadic: a very fruitful period while an instrument is active is followed by long interludes preparing for the next launch by balloon, rocket or space shuttle. "We're photon starved," says Murray. Moreover, X rays are a rare commodity in space; while optical astronomers can collect millions of photons over any one second, X-ray astronomers are lucky to gather a handful or two.

The Smithsonian Astrophysical Observatory has been a major player in X-ray astronomy. Several of the senior scientists started work in X-ray astronomy in the 1960s and early '70s. SAO engineers have the same longevity. And now these veterans are working with the next generation, who were still in kindergarten when their older colleagues began to unveil the X-ray sky.

X rays require a special collector, an instrument markedly different from an ordinary telescope. An optical telescope consists of a mirrored disk that collects the visible light and reflects it to a central point, the focus. But X rays can't be gathered in that way; they would simply penetrate the mirror and be absorbed. An X-ray telescope has to operate like a billiard table. When X rays hit a mirrored surface at a small angle, they don't get absorbed, they ricochet, like well-placed bank shots. In an X-ray telescope, the incoming photons ricochet off the insides of a group of cylinders, mirrored on the inside and nested like a set of kitchen measuring cups. The photons then go through a second set of cylinders that brings the rays to a focus.

The SAO team is building one of two detectors that will operate at the focus. (Two other instruments were originally planned but were lost to budget cuts.) The other camera is a CCD imaging spectrometer constructed by Penn State and MIT scientists. It uses arrays of charged coupled devices to construct a video picture as X rays activate the individual imaging elements. This system complements the High Resolution Camera. The spectrometer, which has a smaller field of view than the HRC, can peg an X ray's energy and collect higher-energy photons. The HRC, on the other hand, is better at collecting lower-energy X rays and is big enough to see extended objects in the sky.

The HRC team had thought that because they were using a proven technology, their task would be relatively easy. The first HRC-like detector, a smaller version designed by Murray, flew aboard the Einstein observatory launched in 1978 (SMITHSONIAN, September 1980). But with the long hiatus between missions, the companies that supplied the camera's parts had lost an edge. "Making microchannel plates became a black art," says Kenter.

Along with developing the HRC, the Smithsonian snared another AXAF plum: the AXAF Science Center, which will be the center for satellite operations, the allocation of observing time and data analysis as the telescope is running. The science agenda is ambitious. "I think we'll see an explosion in the black hole industry," predicts Harvey Tananbaum, a member of the team that discovered the first X-ray binary and now director of the center. AXAF might even be the first to see the pulsing neutron star believed to lurk behind the murky cloud of debris thrown

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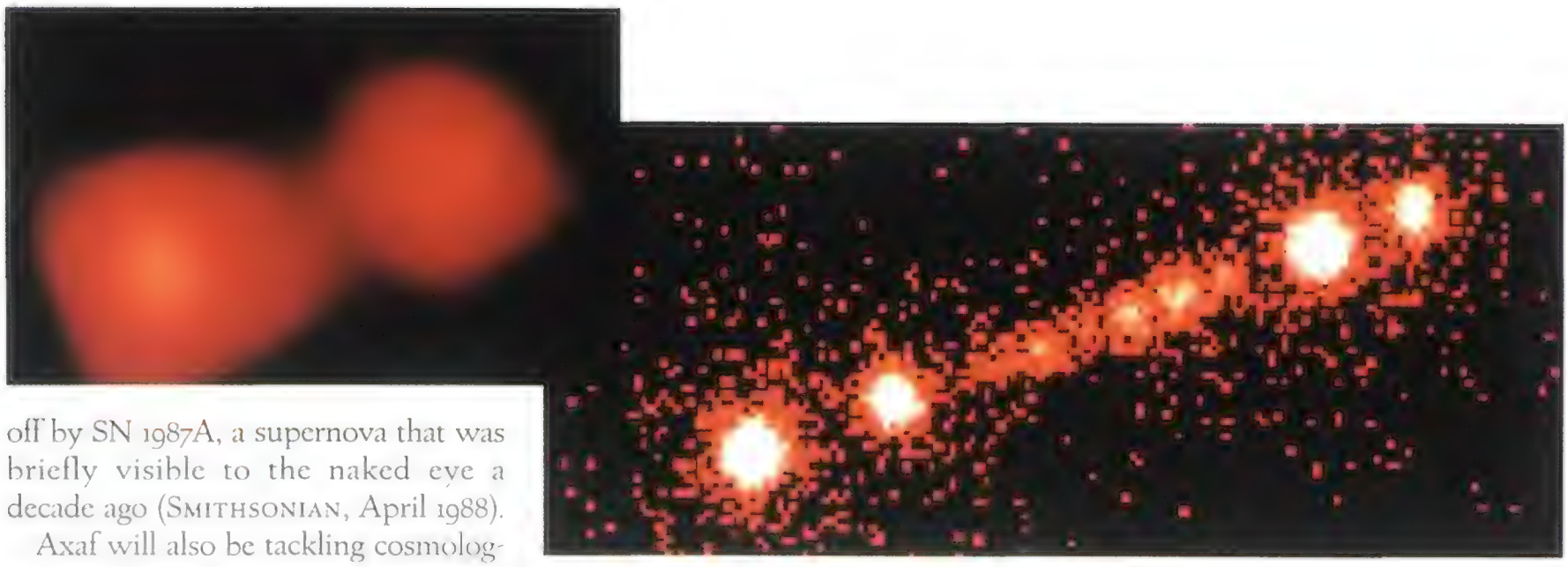

At left is a real X-ray image of an area around a black hole. Above is a simulation of how much better the resolution will be with the new detector aboard AXAF.

off by SN 1987A, a supernova that was briefly visible to the naked eye a decade ago (SMITHSONIAN, April 1988).

Axaf will also be tackling cosmological problems. In his spacious SAO office, Tananbaum takes out two pictures. He first shows an optical image of a rich cluster of galaxies known as Abell 1367. The picture displays nearly 100 extended smudges, each a galaxy containing hundreds of billions of stars. "You're seeing the sum of the light from all these stars, which have temperatures of 5,000 to 100,000 degrees Kelvin. Most of their energy is in the form of visible light," explains Tananbaum.

BUT AN X-RAY PICTURE OF THE SAME REGION, LOCATED about 300 million light-years away, looks entirely different. There are a few bright spots, which might correspond to a galaxy or two, but mostly what are seen are big, smooth patches of gas spread throughout the cluster. Some of that gas got blown out of the galaxies from high-powered supernovas, but it was likely supplemented as the galaxies mingled within the cluster and gravitationally stripped matter off one another. "We're going to map X-ray clusters like crazy with AXAF," says Tananbaum. "There are lots of phenomena that only announce their presence—reveal themselves—when you look at X-ray wavelengths."

The X-ray-emitting gas seen in such clusters as Abell 1367 is very hot, 10 million to 100 million degrees Kelvin, which means it should have diffused over space and disappeared long ago, like steam drifting from a boiling kettle. But it hasn't. "That tells us that something is there to hold it together," notes Tananbaum. "But there's not enough material in the form of stars to do that." That means something else is lurking in space, a dark matter that may simply consist of ordinary celestial objects too faint to be seen from afar, such as black holes or dim white dwarf stars. More intriguingly, it could possibly indicate the presence of a weighty sea of elementary particles yet to be discovered.

As the Cambridge gang wound up its work, Murphy's Law was much in evidence. A microchannel plate was broken because of a flawed vacuum grip. A contractor mistakenly drilled a hole right through the bottom of the camera's titanium case. Computers regularly ran out of memory space during the daily lab tests. Resistors in the camera grid initially turned out to be too strong, distorting the signals. "It's why I don't sleep at night," says Murray.

Eventually, however, the halls were lined with large wooden crates filled with equipment ready to be shipped to the Marshall Space Flight Center in Huntsville, Alabama, for calibration. The experience of the flawed Hubble telescope mirror (now fixed) hovers over the camera group like a shadow. They don't have the same room for error: once AXAF attains its high orbit, the space shuttle won't be able to reach it for fixes.

Construction of AXAF resembled an elaborate military campaign. The telescope's mirrors were ground and polished in Connecticut, shipped to California for coating, then assembled in New York. The science instruments were integrated as a module in Colorado. All the elements eventually met up in California for final assembly. The completed telescope arrives at NASA's Kennedy Space Center in Florida a few months before launch.

During the final hectic days in Cambridge, the clean room remained a haven of peace. Inside the double doors, Medeiros had carefully assembled the microchannel plates onto their holders. Then she meticulously stitch-bonded the wire grid of the camera. She snipped a slim thread of metallic gold off a spool and, with a special bonding machine, linked a wire on the grid, also made of gold, to the pad of resistors that line the circumference of the plate. She needed a microscope to see what she was doing; each thread is thinner than a human hair and only a sixteenth of an inch long. Like a space-age Betsy Ross, she was sewing the pathway for the signal.

"At times, I get overwhelmed by the idea that what I'm working on will soon be thousands of miles above my head," said Medeiros.

The wonders that AXAF ultimately sees will find their way through these golden threads.

Marcia Bartusiak, the author of Thursday's Universe *and* Through a Universe Darkly, *writes often on physics and astronomy*

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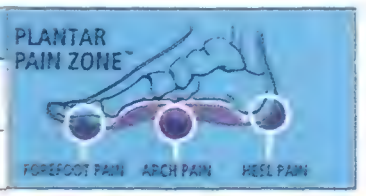

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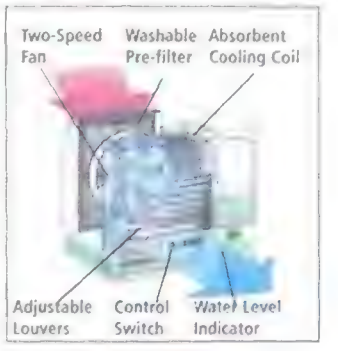

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TALES OF PIRATES, DIPLOMACY AND ESPIONAGE

Tangier

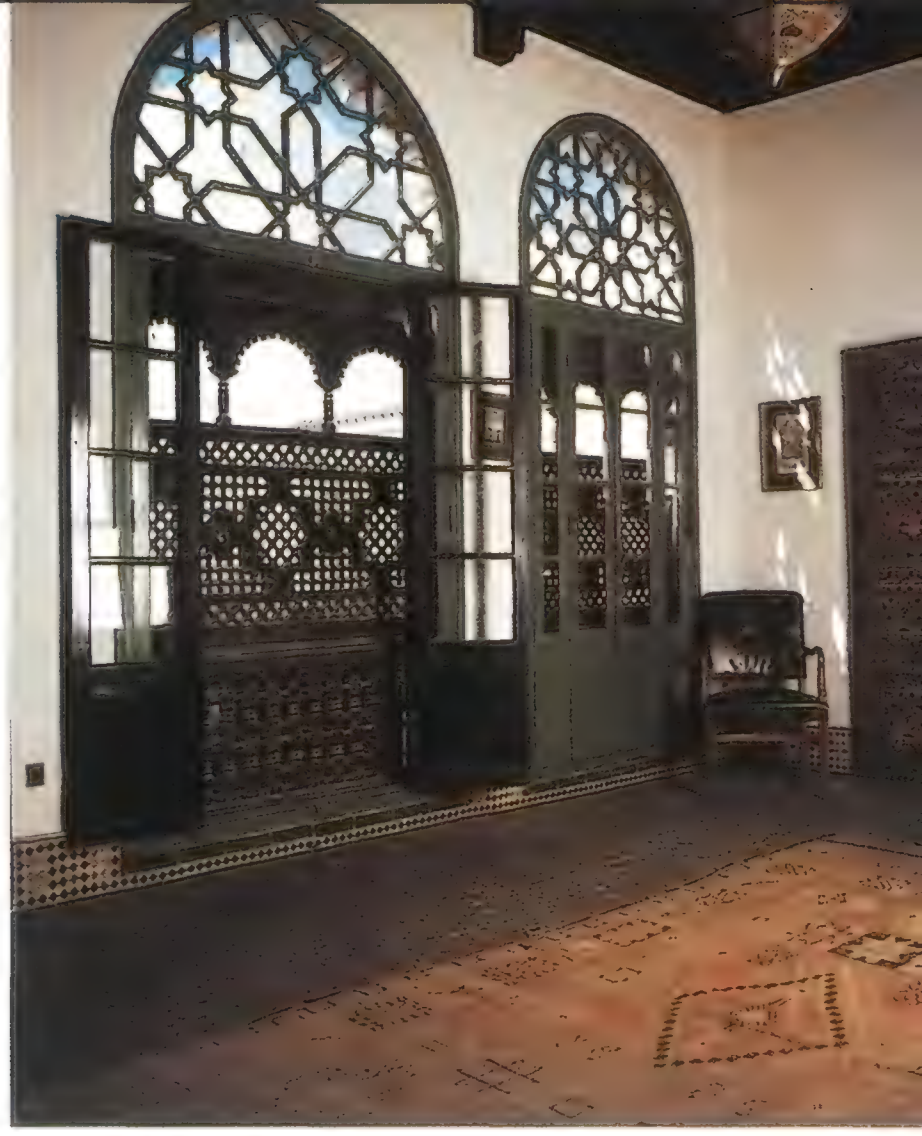
FRAME AMERICA'S LIAISON WITH THE EXOTIC CITY

BY JONATHAN BRODER

ON A BALMY MAY EVENING IN 1904, ION PERDICARIS, A WEALTHY American expatriate, was enjoying a late dinner with his family at his villa in the pine-studded hills overlooking Tangier. From the servants' quarters came the sounds of shouts and barking dogs, but the family at first assumed that the commotion was just another squabble between their housekeeper and cook. Upon entering the servants' hall, however, they discovered a band of wild-looking Arab tribesmen brandishing knives and rifles. In short order, the marauders cut the telephone line, knocked two servants senseless and seized Perdicaris and his grown stepson. As they hustled the pair outside, the leader of the group, a large bearded man in flowing robes with a golden dagger at his waist, paused in the doorway and faced the dumbstruck family. "I am the Raisuli," he announced, raising his arm in a flamboyant flourish. With that, he swept outside, swung onto the back of Perdicaris' prized black stallion and galloped off with his hostages into the darkness.

Sherif Ahmed er Raisuli, lord of Morocco's rugged Rif Mountains, was "the last of the Barbary pirates." His audacious kidnap-

The 1904 kidnapping of Ion Perdicaris (bottom), an expatriate living in Tangier, by Barbary outlaw Ahmed er Raisuli (top) triggered a bizarre international incident.



The Arab Pavilion (right) of the Tangier American Legation Museum is a showcase of traditional Moroccan craftsmanship; at left is one of the mansion's many courtyards.

ping of Ion Perdicaris would set in motion an extraordinary international drama that would pit the might of the U.S. Navy against the wily Riffian bandit, secure Theodore Roosevelt's nomination for the Presidency and ultimately help him retain the White House. Only years later would embarrassing truths about the incident emerge to tarnish Roosevelt's image.

But above all, the Perdicaris affair would serve as a reminder of Tangier's power to taunt and tantalize the American imagination. It was Tangier that had given Americans one of their first tastes of the Near East, with its export of the small, sweet oranges that became known in the West as tangerines. Tangier also gave Americans their first taste of terrorism, helping to harbor the notorious Barbary cutthroats who raided U.S. ships and enslaved its citizens. Even after the Perdicaris kidnapping, the outlaw city, with its mercurial blend of beauty and barbarism, would continue to entice. During World War II, American and German spies turned Tangier into a dangerous den of intrigue. In the years that followed, the city became a haven for smugglers and exiles. American writers such as Paul Bowles and William S. Burroughs also settled there, helping transform Tangier into the most celebrated expatriate colony of its time.

The symbol of America's historic fascination with Tangier is the old American Legation, a rambling, three-story 18th-century mansion just inside the walls of the mazelike medina, or old quarter. Now a private museum and cultural center, the building is located on the rue d'Amerique, a narrow stone passage infused with the aromas of cumin, tamarind and leather. Designated as a National Historic Landmark in 1981, the structure is the longest-held American property on foreign soil. Last November, the museum celebrated the 200th anniversary of America's diplomatic presence in Morocco with a weeklong series of glittering cultural events.

On a recent visit to Tangier, I dropped by the museum to chat with its director, former diplomat Thor Kuniholm. For the past seven years, the lanky New Englander and his wife, Elizabeth, have lived at the old legation, managing its displays, its academic programs, and the various leaks and cracks that constantly threaten the structure. Kuniholm led me upstairs to the rooftop terrace, guiding me past Moorish arches, antique Moroccan carpets and a library that had once served as a bordello. From the roof we could see the old quarter's whitewashed houses sloping down to the brilliant blue of the Strait of Gibraltar. In the distance, only 20 miles away, the sun-bleached coast of Spain loomed out of the haze.

In 1777, Kuniholm told me, Morocco, with its diplomatic capital in Tangier, became one of the first countries in the world to recognize American independence. In December of that year, Sultan Sidi Muhammad XVI wrote a letter promising his friendship to the new country. America finally responded in 1786 by negotiating a Treaty of Peace and Friendship with Morocco, the oldest treaty of its kind still in force. The infamous Whiskey Rebellion of 1794 had its

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roots in Tangier as well. In an effort to raise the $20,000 that U.S. diplomats had pledged to the sultan, Congress placed a tax on liquor, thus provoking an armed uprising by Pennsylvania farmers.

Kuniholm pointed out the bustling port at the bottom of the hill, a harbor which, two centuries earlier, had come to symbolize North Africa's lawlessness in the American mind. Despite the sultan's respect for the new republic, the Moroccan monarch seemed unable to control the Barbary pirates who used Tangier, as well as other North African ports, as a base for their attacks on American commercial shipping. Kuniholm showed me a copy of a letter from President George Washington to the sultan, dated December 1, 1789. The letter, in Washington's own graceful hand, thanked the monarch for trying to intervene on America's behalf with the pirate pashas of Tunis and Tripoli, whose demands for gold and silver were exhausting the first President's pocketbook and patience. Eventually, the pirate raids provoked America's first official foreign war. In 1804, the 44-gun frigate *Constitution* led into the Mediterranean the squadron of vessels that would ultimately decimate the pirate fleets while the U.S. Marines famously attacked the shores of Tripoli.

Back home, harrowing tales of the Barbary bandits helped paint a portrait of Tangier both as a pirate port and as an oasis of European civilization on the untamed North African coast. That contradictory picture was fairly accurate. Morocco's sultans deliberately kept their distance from Tangier, forcing foreign consuls seeking an audience to journey for days to such inland imperial cities as Fez and Marrakech. Otherwise, the diplomats were restricted to Tangier, which they essentially ran by themselves.

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gier, in 1797, was the aristocratic James Simpson. Next came John Mullowny, a masterful diplomat, on whose watch in 1821 the reigning sultan gave the legation building to the United States. And then there were Samuel Carr, James Leib and the matter of a few lions.

Samuel Carr, who knew little about Morocco or diplomacy, took up his consul's post in Tangier in 1832, and it wasn't long before his inexperience began to show. He accumulated massive debts and on one occasion had to fight his way out of a brawl by drawing his pistol. Soon, his cables pleaded for President Jackson to take him out of "this barbarous country."

Jackson responded by replacing Carr with the equally inexperienced James Leib. But by the time Leib arrived, the strain of the job had driven Carr over the edge. As Leib rode up to the legation on horseback, Carr opened fire. Three bullets passed through Leib's hat, one grazing his head.

Leib survived the attack only to find his days and nights consumed by a problem he never could have imag-

Now a city of some 500,000, Tangier still boasts a strategic, bustling port, sweeping views of the Strait of Gibraltar, a compelling clarity of light and a singular allure.

ined. In November 1833, after visiting the sultan in Fez, Leib received an unexpected token of the ruler's esteem: two horses and a huge lion. The horses were welcome, but the lion presented Leib with a delicate diplomatic dilemma. He couldn't possibly refuse it for fear of insulting the Moroccans, who considered the big cats "sultans among animals." At the same time, the lion was eating Leib out of house and home. The care and feeding of the ravenous beast was costing him a dollar a day out of his annual salary of $2,000. Leib therefore requested that the State Department secure funds to reimburse him and find a U.S. zoo willing to take the lion.

It was eight long months before Leib received a reply. President Jackson told the consul that he could ship the two mounts to Washington, provided they were purebred Arabians. As for the lion, Leib should sell it in Tangier. At his wit's end, Leib disobeyed Jackson's instructions and convinced an American ship's captain to take all three animals to the United States: the cost, $600, came straight out of Leib's pocket.

Like Samuel Carr before him, Leib eventually snapped. The British consul general in Tangier, Edward Drummond Hay, informed Washington that Leib had publicly threatened that the flagship of the American Mediterranean fleet would flatten the city—a bizarre pronouncement considering the United States and Morocco were at peace. Any suspicions about Leib's mental state were confirmed when Hay reported that Leib had spent several nights on the legation roof wrapped in an American flag, hoisting lanterns up and down the flagpole to signal the fleet offshore.

Leib's replacement, Thomas Carr (no relation to former consul Samuel Carr), found the legation's affairs in shambles. No sooner had Carr cleaned up the mess than he received a message from the pasha of Tangier. As a welcoming gesture, the sultan was sending over a special present—two stately, full-grown lions.

Carr responded quickly, declining the gift. But the pasha soon appeared

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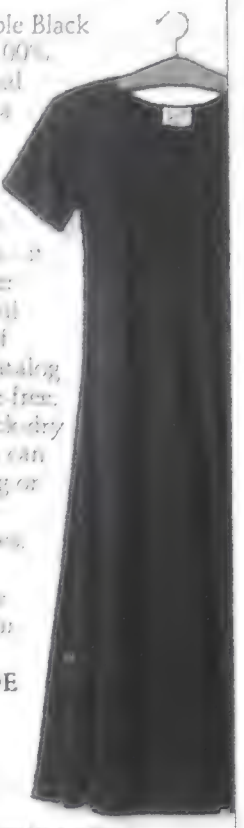
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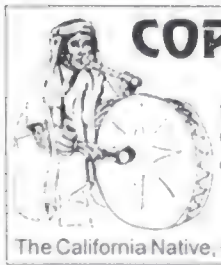
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In the film *The Wind and the Lion*, based on the Perdicaris kidnapping, Sean Connery plays Raisuli, Candice Bergen his victim.

at the legation, accompanied by a troop of soldiers and two large cages. Pleading with Carr, the pasha explained that he would lose his head if he failed to deliver the gifts. Carr argued that a new law forbade U.S. officials from accepting presents that could be construed as bribes. The pasha suggested that if Carr could not accept the lions for himself, then perhaps he would accept them for the U.S. President or Congress? Impossible, Carr said. Frantic, the pasha demanded to know just who made the laws in America. The people, Carr replied grandly. "Then the lions are a gift to the American people!" exclaimed the pasha, signaling his soldiers to open the cages.

From the rooftop of the legation, looking northwest toward the Spanish coast, one can make out the headlands of Cape Trafalgar, site of British admiral Horatio Nelson's 1805 victory over Napoleon. Yet few Americans today realize that those same waters hold historical significance for them as well. In January 1862, the Confederate raider *Sumter* attacked two Union ships just a few miles from Tangier. When two envoys ventured into the city for supplies, they came upon the American Legation and began shouting insults at the flag. Infuriated by the traitorous epithets, U.S. Consul James De Long had the two Confederates arrested. Soon afterward, sympathetic European nationals in Tangier staged a violent protest outside the American Legation, demanding the prisoners' release. Eventually, De Long shipped his captives back to a federal prison in Boston, where President Abraham Lincoln, weary of European protests, had them released. To avoid further trouble, Lincoln relieved De Long of his duties.

Though angry at the indignity, De Long was likely very happy to return home. For Americans raised on Western ways, it was not an easy posting. In his book *The Innocents Abroad*, Mark Twain depicted Tangier as a city of "savages," where the severed limbs of thieves were nailed to the city walls. Twain suggested that if an American "commits a crime so heinous that the law provides no adequate punishment for it, they make him Consul-General to Tangier."

At the same time, Tangier proved irresistibly exotic to its American guests. A short walk from the legation was the Soco Grande, the city's main square, where crowds gathered around jugglers, dancers and snake charmers. In the alleyways surrounding the legation, shops sold brightly colored carpets, aromatic spices and strange-smelling potions. The sun shone 300 days a year, and to top it off, the Americans soon found that beautiful villas could be built cheaply on the slopes west of Tangier. Word of this exotic city spread back home, and by the turn of the century, a special brand of rich, adventuresome American was making Tangier a second home.

The most famous American expatriate at the time was Ion Perdicaris, the son of a wealthy Greek-born gas

magnate from New Jersey and a South Carolina plantation owner's daughter. In 1877, he built an imposing stone villa on a cliff overlooking the sea outside Tangier. There, Perdicaris settled down to a life of leisure—painting, riding and hosting lavish parties for the city's growing community of wealthy expatriates. His kidnapping by Raisuli in 1904 shattered Tangier's fashionable image and once again reminded Americans of its potential for perfidy. Overnight, Raisuli dominated the front pages, and Americans learned how this legendary figure plundered and raped, slaughtering anyone who stood in his way.

Four days after the Perdicaris abduction, a messenger delivered Raisuli's terms. On top of the usual demands for money and the release of his imprisoned tribesmen, Raisuli insisted that the sultan appoint him governor of the coastal areas surrounding Tangier. The brigand also demanded that the United States and Britain guarantee the sultan's compliance, thereby setting the stage for a full-blown international incident

The Perdicaris kidnapping rocked Washington, where President Theodore Roosevelt saw it as a challenge to America's prestige as a new world power. Characteristically, he sent an entire squadron of warships steaming into Tangier Bay. But behind Roosevelt's bluster, the United States had no hard intelligence on where Raisuli was holding the captives, and every indication that the bandit would butcher them if challenged. Roosevelt publicly continued to threaten the use of force, but secretly prevailed upon the sultan to negotiate. His theatrics reached their perfect political pitch in June at the Republican Convention in Chicago, when the famous ultimatum "This Government wants Perdicaris alive or Raisuli dead" was read out to thunderous applause.

Left unspoken was the fact that, back in Tangier, the negotiations for Perdicaris' release had already succeeded. Under U.S. pressure, the weakened sultan had agreed to all of Raisuli's demands. On June 25, a column of 30 mules carrying $70,000 in Spanish silver dollars, along with Raisuli's released comrades, was led out of Tangier to a prearranged rendezvous in the mountains.

Perdicaris' account of his 37 days as Raisuli's hostage was not what anyone had expected. Raisuli had been charming and hospitable, ultimately giving his captives their own tent, mattresses and servants. Food was plentiful, and dinner conversations with the mountain chieftain were intelligent and enlightening. On subsequent visits to Washington, Perdicaris was lionized in the American press and became one of Roosevelt's favorite guests at the White House. Only many years later did a well-kept secret detail of the affair emerge to provide its extraordinary epilogue. According to a 1933 biography of Secretary of State John Hay, Roosevelt had learned just days after the kidnapping that Perdicaris wasn't even an American citizen. Indeed, records showed that at the beginning of the Civil War the young Perdicaris had traveled to Athens to take out Greek citizenship in order to prevent the Confederacy from seizing

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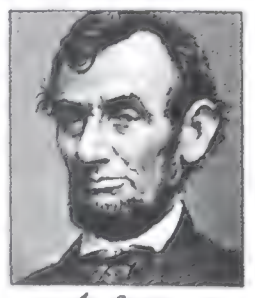

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the South Carolina estate left to him by his mother. After the war, he apparently never bothered to have his American citizenship reinstated. Hay kept this awkward circumstance quiet, and the popular Roosevelt was elected by a landslide.

While historians took note of Roosevelt's deception, Hollywood would distort the historical record even further. In the 1975 film *The Wind and the Lion*, starring Sean Connery as Raisuli, it was Perdicaris' widow, played by Candice Bergen, who became the hostage.

Meanwhile, with real characters like Raisuli eroding the sultan's power, it was not long before Morocco splintered and the European powers stepped in. In 1912, France claimed Morocco as a protectorate, ceding the extreme north and south of the country to Spain. Tangier, however, was excluded from the Spanish enclave, and in 1925 the League of Nations declared the city and its environs an International Zone. Tangier's extraterritorial status lasted until the outbreak of World War II. After the Germans overran France, and French Morocco was put under the authority of the collaborationist Vichy government, Spain, betting on an early German victory, moved troops into Tangier just after midnight on June 14, 1940.

Tangier turned into a cauldron of espionage and international intrigue.

Though the real fighting remained over the horizon in Europe and farther east in North Africa, Tangier turned into a cauldron of espionage and international intrigue. For the United States, which badly needed information to prepare for its invasion of North Africa, the Tangier legation provided an ideal listening post. In the spring of 1942, America's wartime intelligence branch sent over two new agents under diplomatic cover: Gordon Browne, a businessman who had worked in Morocco, and Carleton Coon, a Harvard anthropologist whose fieldwork in Morocco before the war had given him a wide circle of friends among the Riffian tribes.

Coon and Browne became legendary spies. Old friends from their prewar days in Morocco, they developed a vast network of sympathetic informers to glean information on Axis defenses and Germany's plans to invade North Africa. On the cliffs overlooking the strait, their Riffian informers watched for German U-boats, so they could radio their sightings to Coon and Browne at the American Legation. Operating from a secret radio room, the American agents could then relay the information in code to the British base at Gibraltar. The radio room is still intact, concealed behind a mirrored wall in one of the legation's former bedrooms.

"The real atmosphere of intrigue in Tangier dwarfed anything Hollywood could come up with," Browne told me in an interview before his recent death. Both the American and the German agents employed informers from their hotels' respective staffs to keep tabs on each other. "When we left the hotel to go anywhere, somebody was always waving a handkerchief or a towel out the window to signal the Germans," recalled Browne. Chambermaids removed any pieces of paper left in the Americans' rooms and gave them to the Germans. Coon liked to harass the hotel informers—and keep the Germans busy—by writing nonsensical notes in an imaginary code, tearing them up and dropping the pieces into the toilet.

After the war, the Spanish withdrew, and Tangier, back under international administration, changed once more, earning a reputation as one of the world's most unrestrained cities.

Carleton S. Coon (left) and Gordon Browne served as OSS spies in Tangier during World War II.

While Europe lay in ruins, with tight controls on everything from money to immigration, Tangier boasted no currency restrictions, no trade barriers, no immigration quotas, no red tape and no taxes of any importance. Happily, Tangier's only constraints were its banking secrecy policies, which surpassed those of Switzerland. With its Spanish Casino and a palm-studded corniche lined with fashionable hotels and shops, the city possessed the air of another Monte Carlo.

The only requirement for admission to this sun-drenched paradise was a legal passport. Once a person got in, no questions were asked. "Life here seems almost too good to be true," wrote a correspondent for the *New Yorker*. "It is one of the few places on earth where anything goes."

This was the city that captivated the American writer Paul Bowles, who had first visited Tangier in 1931. For the past 50 years, Bowles, now 87, has lived and worked there. Just as Hemingway captured the Paris of the "Lost Generation" after World War I, Bowles conveyed the romance and danger of North Africa in his novel *The Sheltering Sky*, and immortalized Tangier in books like *Let It Come Down*. Lured by his descriptions, and Tangier's sunny insouciance, American writers and artists flocked to the city in the 1950s and '60s

I dropped by one afternoon to visit Bowles at his Tangier apartment, where he lives in shadows, screening out the sunlight with drawn shades and a thicket of leafy plants. Bowles, white-haired and dapper in his silk pajamas, had just awakened from a nap. He fondly recalled Tangier in the postwar years as a glamorous scene of all-night parties, where no lifestyle was out of bounds. "People came to Tangier to have a good time," he said. Everything was available for a price, and that price was usually cheap.

Tangier's liberal legal system further fueled the city's unrestrained atmosphere. In 1954, Bowles remembered, William Burroughs sought solace in Tangier after accidentally killing his wife while trying to shoot a glass of whiskey off her head in Mexico. In a small pension called Villa Muniria, Burroughs fed his heroin habit, fired his pistols into the ceiling and wrote his sordid classic, *Naked Lunch*. Upstairs, Jack Kerouac took a room that opened onto a large, red-tiled veranda. Poets Allen Ginsberg and Gregory Corso followed, and soon the pension was dubbed "Villa Delirium."

More fashionable visitors, such as novelist Truman Capote and playwright Tennessee Williams, were also drawn to Tangier. Bowles described a party that Capote threw at the Caves of Hercules outside the city. The entrance to the caves had been hung with curtains, and inside an orchestra played Andalusian music. "For refreshments, there was nothing but champagne and hashish," recalled Bowles.

When they weren't partying, Tangier's habitués gathered at sundown at the Parade Bar. "There was a garden with tall palm trees, where Bill Burroughs always sat in his coat and tie, looking like a Protestant preacher," recollected Bowles' friend, Joseph

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McPhillips, headmaster of the American School of Tangier. "Mounted on the wall was a slipper that belonged to Eugenia Bankhead, Tallulah's sister, who drank champagne from it one night and left it behind."

With Morocco's independence from France in 1956, however, Tangier's star began to fade. The city lost its coveted international status, and as King Muhammad V directed his resources toward Casablanca and Rabat, Tangier lost much of its appeal for the international set.

For a while, the United States maintained its antiquated legation in the medina, but finally moved the staff to a more modern district in 1961. State Department administrators would have sold the building had it not been for the resourcefulness of a few sentimental U.S. Foreign Service officers. In 1975, Carleton Coon, Jr., a senior diplomat at the U.S. embassy in Rabat and son of the OSS spy, received a cable from Washington asking how the embassy was planning to mark America's upcoming bicentennial. Seizing upon Washington's interest, Coon organized a group of like-minded colleagues and friends, formed a nonprofit foundation and turned the legation into a private museum. With funds from the foundation and the State Department, Harland Eastman, the U.S. consul in Tangier, led a massive renovation. Excavating the building's cluttered storerooms, he dusted off old portraits and other memorabilia. He and Coon even managed to liberate a painting by Ion Perdicaris from the U.S. ambassador's residence in Rabat and return it to the old mansion. On July 4, 1976, the Tangier American Legation Museum opened its doors. Since then, the museum has taken as its own the legation's original mission of fostering American-Moroccan understanding.

In the meantime, expatriates like Bowles and McPhillips cling stubbornly to their adopted city. "It still has this attraction, this inexplicable ability to pull at your heart and soul," McPhillips says. "There's the light, the air, the wind blowing through the strait, the interplay between Europe and Morocco that will never change. Tangier is indestructible."

Washington, D.C.-based writer Jonathan Broder is a former Middle East correspondent.

Paul Bowles (seated, right) and Beat Generation writers William Burroughs (standing, far left) and Allen Ginsberg (center in glasses) gather outside Tangier's "Villa Delirium."

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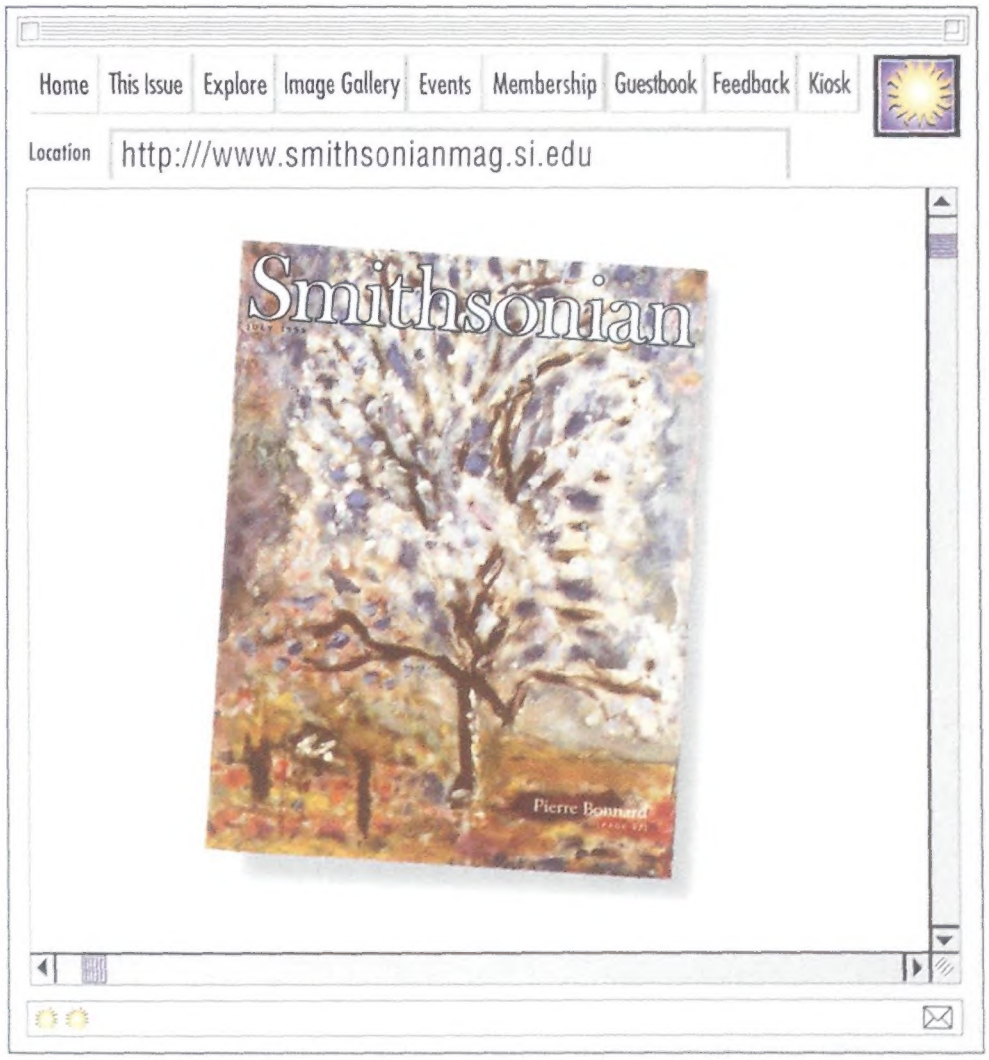

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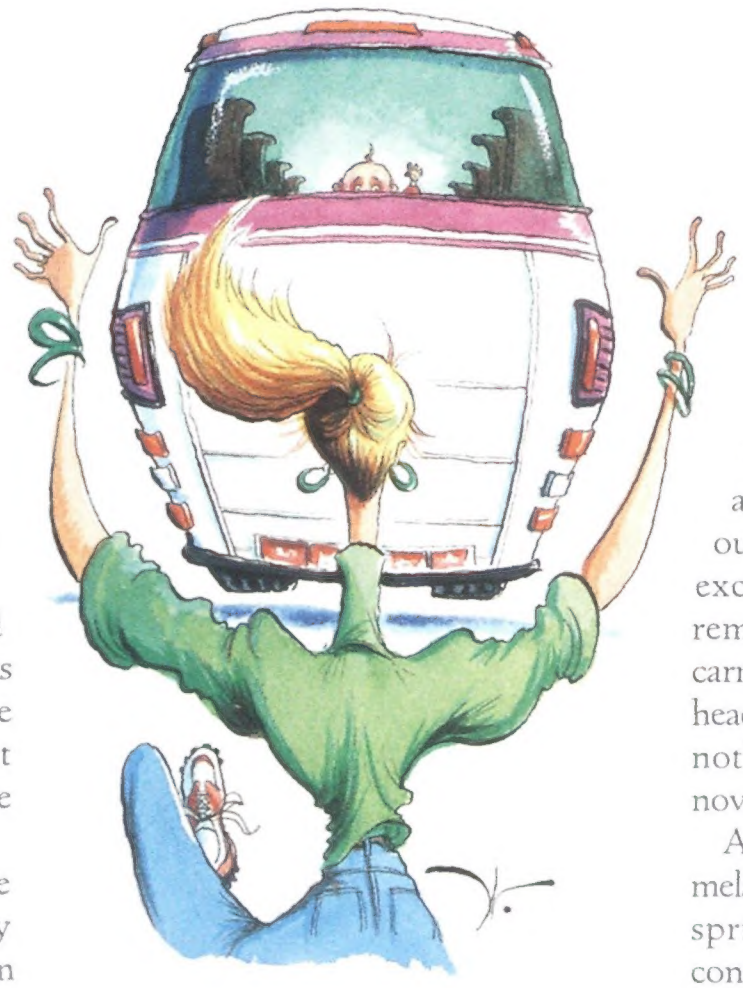
THE LAST PAGE

Memory Blank

BY CYNTHIA CAVNAR



I GREW UP IN A BOOKISH home. We moved stacks of books off the table in order to eat and off chairs so that we could sit. Naturally, I read prodigiously. Unfortunately, I rarely remembered much in the way of actual content.

My father must have suspected this because when I was 10 years old he gave me a lapel button. "We never guess," it said, "we look it up." Well, of course we did—if we could remember the topic.

After years of secret shame, I have finally discovered why my memory is so unreliable. I have bad CREB. In layman's terms, I'm firing blanks.

This liberating self-diagnosis came to me courtesy of a recent magazine article. Scientists, it seems, have identified CREB as the gene that triggers much of the neural pyrotechnics responsible for long-term memory. What is meant by "long-term" is, of course, subjective. For our purposes, long-term memory refers to the time between when the brain first absorbs something and when it is no longer able to retrieve it—about 1.5 seconds, in my case.

I'm talking about impaired memory gene function. Here's how it works. I was 32 when I gave birth to my third child, Tim. One afternoon I bundled him into a carriage, walked to my sister's house for a neighborhood party and parked Tim in the shade of a tree. An hour later, as I was leaving, a friend ran over, clearly agitated. She waved toward the tree. I looked and yes, dear God, light dawned. The synapses flared, my memory stirred. I had a baby! I retrieved him and crept home, vowing to bind him to my wrist until we achieved the sort of mind-meld I so obviously needed.

"Oh my God," she cried, "I left the baby on the bus!" And so, in a way, had I.

Long before that incident, I saw a T-shirt that spoke to my spirit. A Brenda Starr-type woman was emblazoned across the front, her face twisted in anguish. "Oh my God," she cried, "I left the baby on the bus!" And so, in a way, had I.

It is some small consolation to discover, even at this late date, that perhaps my affliction has biological roots. And yet I remain troubled, for not only have I misplaced a baby, I have also wandered aimlessly through my brain seeking the most ordinary yet strangely elusive information. If my memory can generously be described as "selective," it is so in a most distressing way. I can rattle off all the wives of Henry VIII but have been known to address my sons by the name of our dog. This wouldn't be so bad except that her name is Jenny. I remember that a geek is actually a carnival performer who bites off the heads of live chickens but can tell you nothing of the Robertson Davies novel where I picked up that tidbit.

All this fills me with a certain melancholy. The phrase "not so bright" springs to mind, and would seem confirmed by my sixth-grade report card. In the spot reserved for the parental signature, my father wrote: "What can we do?"

Now I have achieved some measure of peace. Not only do I understand the root of my problem, but science is rushing to the rescue. Apparently, by tinkering with the CREB of a fruit fly, researchers have produced a fly with a photographic memory. The question, of course, is how to accomplish the same feat with humans. I say eat the fly, but I might not grasp all the complexities here.

On the other hand, I'm getting desperate. My son Matt, an otherwise extremely bright young man, has inherited my deficiency. Recently, he flirted with sudden death when he forgot to unplug the toaster before plunging in a knife to extricate a piece of toast. Not long before, he ruined the garage door when he forgot to raise it before backing the car out.

I think there's a fruit-fly sandwich in his future.

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